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READY-TO-SERVE AND MINIMUM-RATE CHARGES.

In several cases courts have upheld minimum rates or ready-to-serve charges for electrical supply.

Such a case came up in New York, where the electric company made a minimum charge of $1.50 per month for lighting service, besides the meter rate of one cent per sixteen-candlepower lamp per hour. This minimum charge was not made, however, where the energy consumed as measured by the meter amounted to $1.50 or more per month.

While holding that a consumer who refused to agree to pay this minimum charge was not entitled to the electric service, the Court said:

"It is stated * * * that each additional lamp connected with defendant's system necessitates an additional investment by it in distributing conductors and local appliances of about $20 in addition to the cost of generating and delivering the electric current; that the number of lamps which the plaintiff desired was eleven, and that the total investment thus made necessary in order to comply with this demand for service was at least the sum of $220. How, then, can it be said that a fixed charge, not based upon actual consumption, is of itself improper or unreasonable? * * * One consumer with the same number of lamps will use more than another. In both cases the return to the company may be remunerative, or the use of one may be so inconsiderable as to involve a loss. To meet this contingency the monthly minimum charge of $1.50 is made. * * * I can see nothing unreasonable in this when the service, as I have defined it, which the company is obliged to render is considered. It is not a penalty for a failure to use defendant's product, but is properly to be regarded as compensatory for that part of the service which is at all times being rendered in the maintenance of the apparatus and connections through which the electric current is made available to the consumer for the production of light at his pleasure." Gould vs. Edison Electric Illuminating Company, 60 New York, Sup. 559.

Within the past three months two cases have been decided in favor of ready-to-serve charges. One of these cases was a suit by an electric-lighting company for services rendered at the rate of ten cents per kilowatt-hour, plus a ready-to-serve charge of ten cents per lamp socket per month on twenty-four sockets, plus twenty-five cents per month for meter rent, making a total of $9.32 for the bill in one month. The rate had

formerly been fourteen cents per kilowatt-hour, with no ready-to-serve charge.

In upholding these charges the Court used the following language:

"It was urged before us that defendant cannot in any event be called upon to pay a charge for the power or current on hand ready for service, but which in fact is never served. I cannot so view it. The two charges, taken together (that is, for the current as shown by the meter and for the current necessarily on hand to be used when lighted), is simply a method of arriving at a fair rate for energy supplied to defendant." Chambers Electric Company vs. Cantwell, Eastern Law Reporter of Canada, June 1, 1909.

Another case was an action by a consumer to recover a penalty from the electric company for failure to supply his residence with electric light as required by a statute which provided that no meter rent should be charged. The refusal of the electric company to supply the light was due to the fact that the consumer would not agree to pay a ready-to-serve charge of $1.11 per month.

In the course of an opinion sustaining the right of the company to make the ready-to-serve charge, it was said:

"Nowhere does this statute attempt to say that persons using different quantities of the commodity in a given time must be charged the same price per thousand units, nor that a minimum charge per month for service may not be imposed. The Legislature did not intend to compel the company to put in a meter and hold itself in readiness to serve those who use none of the commodity to be supplied. * * * So, it matters not whether it be termed a 'readiness-to-serve charge' or a 'minimum-rate charge.' It amounts to the same thing, and is not forbidden by the language of the statute. * * * A regulation of the charges for such service should be just to the company as well as to all its patrons, so as to allow compensation to the former, and reasonable, uniform rates to the latter. One class of patrons should not be favored at the expense of another." Little Rock Railway and Electric Company vs. Newman, 120 Southwestern Rep. 824.

THE COST OF DEFERRED MAINTENANCE.

In the administration of industrial plants the problem of economical maintenance is a matter of constant engineering interest. If operating conditions remained stationary after the establishment of a plant, it would be a comparatively simple task to forecast the amount of money which each year's service legitimately requires for keeping the equipment in efficient condition; but with the tendency toward expansion of output and the changes in methods of production which appear in most installations from time to time, the standards by which maintenance may be judged are continually varying, when the disbursements for one period are compared with those for another. This means that unless general conditions, as well as analyses of the expenditures on the unit basis, are taken into account, the plant is liable on the one hand to suffer from spasmodic appropriations for improving its equipment efficiency and on the other from unwise changes in its design or unjustified departures from previous practice when extensions become necessary.

The fundamental requirements of adequate maintenance are not complex, for they are simply included in the exercise of that prudent foresight known in the vernacular as the "stitch in time," which reduces waste in the field of machinery operation in the same manner as in other fields where wear and tear are higher. The same causes always produce the same results. Unfortunately, with complicated systems of apparatus manipulated by even more intricate personalities, it is extremely difficult to sift the causes of wear and tear to the bottom, and to reduce to figures which are worth anything, the service performance which brings about a definite amount of wear on a machine or group of appliances of known characteristics. In the difficulty of the problem lies its fascination, however, and every engineer who analyzes the performance of his equipment in a scientific way helps to lighten the dark and unexplored areas of puzzling experience with equipment failures and excessive expenditures for rehabilitation. The difficulty is that in so many cases the data collected are not sufficiently complete to enable accurate judgments to be passed. The number of factors neglected or approximated is too great.

Four years' maintenance costs taken from the unusually complete records of a central station of the engine-driven type illustrate the need of full data before one can criticize the administration of a plant from the financial point of view. The station capacity at the beginning of the four years was 450 kilowatts, and in the second year it became 1,250 kilowatts through the addition of another generator. No further increase was made. The energy generated increased from about 930,000 kilowatt-hours to 1,400,000 kilowatt-hours. In the first year the cost of station building, steam and electrical equipment maintenance per kilowatt-hour was 0.20 cent; in the second year it was 0.11 cent; in the third, 0.26 cent; and in the fourth, 0.16 cent. A tenth of a cent is not a very large affair in itself, but when applied to over a million-and-a-third kilowatt-hours in a year it amounts to over a hundred dollars a month. Before an analysis can be made of even so considerable a variation as this in the repair account of any particular subdivision of the station apparatus, one must know not only what were the larger items of expense which produced the variations in unit-repair cost, but the extent of service which was imposed upon different units in the station, the approximate outputs of each, number and extent of severe overloads, character of the preceding repairs, magnitude of fluctuations in the load curve, occurrence of temporary adjustments, and the number and nature of any noteworthy failures. It would be a great help in the future administration of such plants if the unusual occurrences could be recorded more fully by the engineers in charge of the stations, either in the regular log of the daily runs, or

in a special emergency book having pages of sufficient size to permit the insertion of all the data which would form the principal support of a thorough report of the situation in each instance. It is not enough from the standpoint of high-class maintenance analysis to state that a certain increase in the steam-plant repairs for a given month was due to the replacement of a cylinder head on No. 2 engine. Something of the history of the engine before the change became necessary should be available to the man who has to study the prospective expenditures of the plant in the light of its past records. It is true that, except in very rare instances, it is too much to expect the average operating employe to put down the full and accurate particulars desirable in connection with equipment failures or pending replacements, but this matter can be handled profitably by the engineering staff if the right questions are opportunely considered in conference with the operating force.

It seems to some managers as though refined studies of equipment maintenance were worth little in their effect upon expenses, but experience has shown, notably in the electric-railway field, that the more carefully defects are analyzed, the fewer occur, provided that the results are exhibited before the division heads in charge of the detailed work in the car service. In one notable instance the company has cut down the failures of its cars on the streets by nearly twenty per cent a year through a tabulation of the defects each month and a study of them in the presence and with the co-operation of its car-house foremen and division superintendents. There is still need on this system, however, of getting to the bottom of obscure troubles which occur, for only by such a course can costly interruptions be minimized. Reduced failures mean decreased shop expenses and a lower rate of depreciation, but service reliability is worth more as a rule than a saving in repair costs.

The relation of service reliability to maintenance, and particularly to deferred repairs, neglected through pressure of traffic or shortage of funds, is at present extremely indefinite, but none the less direct and inescapable. When the campaign for economical operation reaches its height in any company it is an easy matter to cut down the repairs from those desirable under the most prosperous conditions to the fewest which will keep the system in motion. The shrinkage in repair bills which such a policy often produces is gratifying in its effect upon net earnings, but there are few policies so hazardous as that of cutting down the necessary routine repairs. Not only are subsequent expenditures for maintenance relatively heavier, but the danger of accidents is increased, the life of the equipment is shortened, the salability of the plant diminished, and the economy of production often seriously impaired. Anxiety to declare early dividends and to maintain a well-established dividend rate should never be permitted to result in the neglect of equipment through deferred maintenance. In the long run the cost of deferred maintenance will prove to be greater than that of normal and regular repairs, faced squarely as they become due in the exigencies of operation.

ASSISTED PLANTS.

In the division "Central-Station Practice" in this issue we reprint a timely article which appeared in a recent issue of the *Manchester Guardian,* one of the leading English newspapers.

The writer of the article in question would appear at first to be considering only the interests of the large manufacturer who could afford profitably to run an isolated plant to supply his minimum demand while using the nearby central station as very much of a convenience to supply the extra current for his peak loads. This extra current, although it might be of considerable amount for short periods, would in most cases be inconsiderable in the aggregate compared to the total load of the factory, and of itself would prove very undesirable business to the central station. Only in dense manufacturing centers, where many factories within a comparatively small radius would be available for such service, would this business on the whole be likely at first to provide a fairly uniform profitable day load to the central station.

But this is not all the argument. Many plants using prime movers other than electric, as well as those using electric service from isolated plants already installed, would be available for their peak-load business, especially in cases where the prime movers in use are not flexible enough to stand an overload, as is the case with gas engines. This possible extra business is largely recognized at the present time by most companies. But here is the subtle point, if one may say so, of the article in question. Manufacturers in the main are constantly increasing their business under normal conditions, and what is more natural than the fact that most of the additional load consequent on this increase should automatically be provided for by the central station? Again, existing manufacturer's plant must deteriorate, and in course of time be scrapped, and here again is a chance for the central station which is, under the new arrangement suggested, already supplying part of the load. The whole matter is certainly worth consideration at any rate, and we shall confidently look forward to further developments along these lines. Time alone can tell what is to be the outcome.

AMONG THE CONTRACTORS AND ELECTRICAL SUPPLY MEN.

Why hide your light under a bushel? If you are doing something worth while in a business way let the business world know about it and you will get more work to do, and more people to supply. This is the order of the new department which appears for the first time under the above caption on page 549 of this issue. Send in your orders at your own discretion and we will tell the world of electricity all about it. It is a good idea and in this age of publicity, those who move with the times and are up and doing will doubtless appreciate the opportunity. Be proud of your legitimate efforts and achievements and you will go on to greater success. Nothing was ever lost by being frank and positive when you have a good thing.

DETAILS OF WATT-HOUR METER MANUFACTURE.—VI.

BY JOSEPH B. BAKER.

FACTORY INSPECTION AND CALIBRATION OF INDUCTION METERS (CONTINUED).

Power-Factor and Frequency Adjustment.—Adjustment for zero power-factor is made by changing the rack connections so as to put the A phase on the series winding and the C phase, ninety degrees away, on the shunt winding of the meter. The standard has already been calibrated for zero power-factor with the precision wattmeter in conjunction with the synchronization of the former with the "master." The tester obtains zero power-factor on the rack connections by adjusting the potential regulator. When the position of true quadrature has been obtained, as shown by the disk of the standard coming to rest, the tester then effects the adjustment of the meter under test for zero power-factor by shifting its power-factor adjustment until the disk comes to rest.

The theory of the power-factor and frequency adjustment, and its construction and operation in Westinghouse induction meters, may be explained briefly as follows:

Referring first to the power-factor adjustment: When the load on a meter is purely non-inductive, such as a group of incandescent lamps, the current in the shunt-field coil will lag approximately ninety degrees behind that in the series-field coil. If, on the other hand, the load is changed to one which is purely inductive (power-factor equal to zero), the current in the series coil itself will lag ninety degrees behind the line voltage and would therefore be approximately in phase with the current in the shunt-field coil—under which condition there would be no shifting or forward rotation of field, and therefore no torque on the rotating element. These conditions would obtain exactly were it not for the modifying effect of the resistance of the shunt-field windings, the iron loss, etc. Although the design is theoretically correct to give a lag of ninety degrees on purely inductive load, the distribution of copper, iron and shunt-field air gaps in the practical construction cannot be depended upon to make the lag accurately ninety degrees, and some device must be applied to correct for the margin of difference.

The device that is employed as a power-factor and frequency adjustment operates as a power-factor adjustment by varying the phase relation of the shunt-field flux to the series-field flux, and consists of a stamping (Fig. 38) arranged to constitute a short-circuited one-turn coil enclosing the middle pole of the shunt-field core, as shown in Fig. 36 in the last issue and Fig. 21 in the August 28 issue, in which this piece is lettered P. The presence of this short-circuited loop results in a choking effect upon the shunt element as a whole in its relation to the series flux. An induced magnetic field is set up by the loop, which produces, in conjunction with the magnetic field of the shunt, a resultant field which is exactly ninety degrees behind that of the series coil. The reinforcing or modifying effect of this resultant field is utilized, to any extent that may be neecssary to rectify the phase relation between the shunt and series fields, by setting this adjustment (or "shading coil," as it is sometimes termed) in the appropriate position somewhere between the following limits: Up near the top of the middle pole of the shunt-field core, on the line M—N, furthest from the shunt-field air gap, where the effect is a minimum; and down against the shunt-field air gap, on the line x—x¹, where the effect is a maximum.

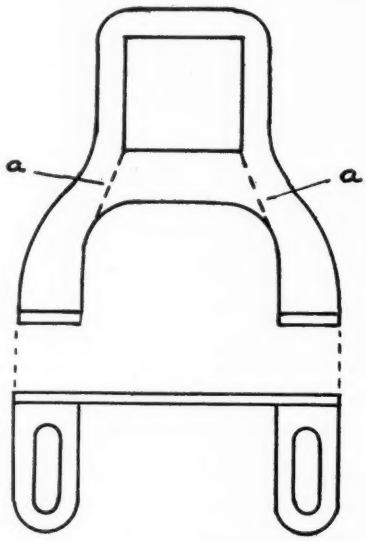


FIG. 38.—POWER-FACTOR AND FREQUENCY ADJUSTMENT.

This method of swinging the resultant into exact quadrature is shown graphically in the vector diagram, Fig. 39, in which:

OA is the voltage of the shunt-field coil.

OY, the current passing through the series-field coil.

YOA, the angle less than ninety degrees due to iron and copper losses in the shunt field.

OS, the induced voltage generated in the "shading strip," exactly opposite in phase to OA, but very small in value; the current passing through the shading strip being in phase with this voltage and represented by OC.

The current OC and main current OY have a combined magnetizing effect on the iron core, which is found by forming the parallelogram OCXY, giving OX as the resultant effect. By raising or lowering the shading strip, the resultant flux can be shifted back to the ninety-degree phase relation, as shown by OX, the meter being thereby adjusted so as to read correctly under all conditions of power-factor.

In contradistinction to the light-load adjustment, the power-factor and frequency adjustment has no unbalancing effect upon the shunt field, *i. e.*, the speed of the meter is unaffected on non-inductive load, because the short-circuited loop encloses the middle pole. The setting of this adjustment is a detail of the calibration of the meter at the factory, and is accomplished by loosening two screws, passing through the shield and tapped into the meter case, and clamping under their heads the slotted lugs of the stamping. The setting is unaffected by variation of jewel friction, and therefore never needs to be changed by the customer's meter inspector.

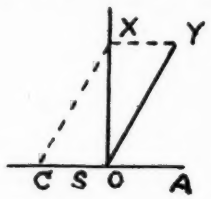


FIG. 39.—DIAGRAM OF POWER-FACTOR ADJUSTMENT.

The function of the device shown in Fig. 38 and at P, Fig. 21, as a frequency adjustment may be explained briefly as follows:

In 133-cycle meters the practical construction of the meter gives more nearly exact lagging than in meters for sixty-cycle service, and renders the employment of a power-factor adjustment unnecessary. But inasmuch as 133 cycles is an odd frequency, and as the services employing that frequency are expected to be changed to ordinary sixty-cycle services, 133-cycle meters are sent out from the factory equipped with an adjustment consisting of the stamping shown in Fig. 38, cut open on the dotted lines a, a, to make an

open yoke instead of the short-circuited loop described above. This yoke is secured by the same two screws that are employed to hold the stamping in the sixty-cycle meter; but one of the screws is fitted with a fiber bushing, which interrupts what would otherwise amount to a one-turn coil (as in the case of the uncut stamping above referred to, though of larger diameter) when the meter is to be changed to sixty-cycle service. The circuit of the adjustment is, however, in this case completed through the meter fields—in the absence of the fourth side of the square loop—by removing the fiber bushing again and tightening the screw. This "screw-driver adjustment" for adapting the meter to either of two frequencies is obviously superior to other methods involving soldered connections.

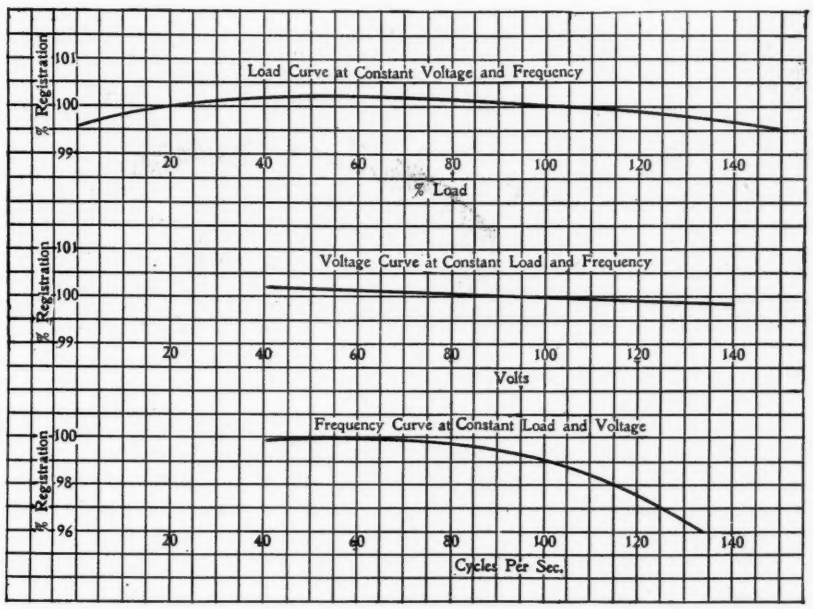


FIG. 40.—VARIATION OF ACCURACY OF INDUCTION METERS WITH FREQUENCY, VOLTAGE AND LOAD.

Although the above-described adjustment is provided on all sixty-cycle meters of this type, it is claimed that their accuracy of registration is but little affected by wide variations from normal frequency—for example, only three or four per cent error is introduced when a sixty-cycle meter is used on a 133-cycle circuit, or vice versa. The variation of percentage accuracy throughout a wide range of frequency is shown in the bottom curve in Fig. 40.

SEALING METERS.

In so-called unsealed meters, such as the T R W meters, the entire meter is accessible to the purchaser (central-station company) and has therefore only the one seal—the central-station company's seal on the meter cover. A single seal, on a loop of wire, joining the two wing nuts that secure the cover, may be used, or a separate seal on each wing nut—the former is the more commonly found. The ordinary round ball or "bullet" seal is used by many central-station companies, but a better form is one in which the two wires of the loop are arranged to cross inside the lead, so that the wires cannot be drawn out without deforming the seal. The wire of the seal may pass through a hole in the wing-nut post above the wing nut, or, better, through that hole and a hole drilled through one wing of this nut also. A felt washer underneath the metal one may be used to advantage to bar the hole in the meter cover against insects, moisture, etc.

In sealed meters, such as the Westinghouse, the meter has two compartments, with separate covers—the meter compartment proper, which is not accessible to the purchaser (central-station company), and the terminal chamber, which is accessible. Sealed meters are accordingly shipped from the factory with the seal of the meter compartment compressed, but the seal of the terminal chamber uncompressed, ready for the central-station company's sealing tools.

The manufacturers of so-called "sealed" meters—in which the binding posts are in a separate compartment, sealed separately from the meter compartment proper—claim the following advantages over unsealed meters, in which the binding posts and the meter are under the one seal of the central-station company:

The cover of the meter proper need not be removed to install the meter, so that there is no risk of getting dust, dirt, bits of insulation, etc., into the meter. The having of separate seals for the meter compartment and terminal chamber protects the central-station company from the carelessness of its own installers. A mistaken impression exists among many central-station men that companies manufacturing sealed meters disclaim responsibility in all cases when the seals are broken. The sealing of the meter, however, so far from importing such a narrow attitude on the part of the meter manufacturing companies, protects the latter and the reputation of their meters from incompetent local calibration, and at the same time really works to the advantage of the purchaser by protecting the meter from tampering by unauthorized persons. The manufacturing companies examine all meters returned as defective, with seals broken, and assume responsibility for repairs where the trouble is due to defects in manufacture or in the factory calibration.

Meters having a light rotating element lend themselves to shipment as sealed meters; whereas meters having comparatively heavy rotating elements cannot be shipped sealed, because the "pound" of the rotating element on the jewel bearing in transportation would be very liable to damage the latter, and the meter must be equipped with a locking device which lifts the rotating element off the jewel during shipment and which must be released when the meter is installed. Thus the rotating element of a well-known make of unsealed induction meter, weighing thirty-three grammes, is equipped with a locking device and is shipped upside down; whereas another well-known make of induction meter, having a rotating element weighing only fifteen grammes, has no locking device, and is shipped sealed. For the latter meter it is claimed that the step bearing is not injured in shipment, this sturdiness being due not only to the lightness of the rotating element, but to the small vertical play (one-thirty-second inch) which it has. That is, both the mass of the rotating element and the distance through which it can move to acquire momentum, when the meter is shaken.

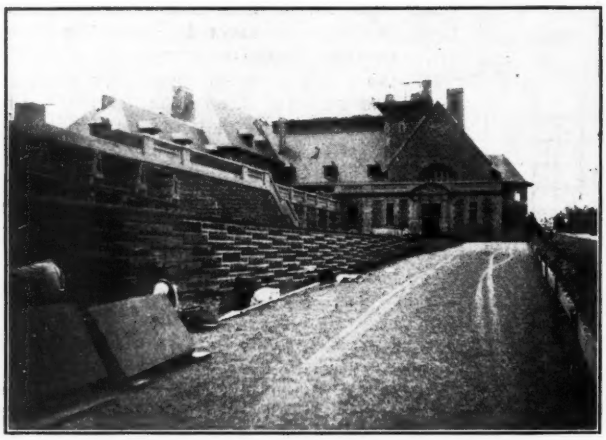
[THE END.]

Japanese Bureau of Electricity.

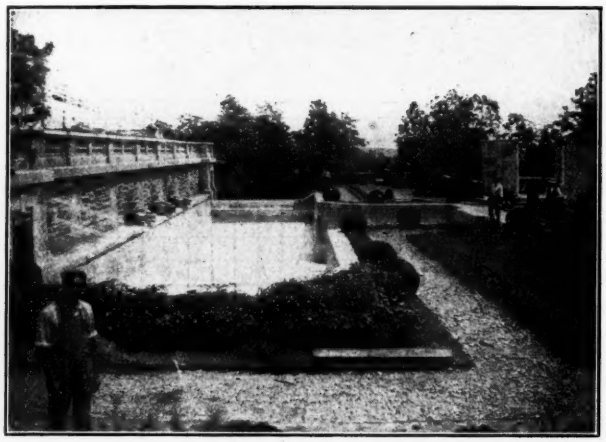
A Bureau of Electricity has been added to the Japanese Department of Communications, in order to cope with the enormous growth of the electrical industry. In five years the demand for electric current has risen from 58,000 kilowatts to 380,000. The amount generated by hydraulic power has risen from 16,000 to 62,000, and permits have been granted for another 158,000 kilowatts. Of 817 registered manufacturing industries, 198 use electricity.

Electricity in the Arden Residence of the Late E. H. Harriman.

The magnificent residence of the late Edward H. Harriman at Arden, N. Y., affords an interesting example of how useful electricity has become in large-scale domestic applications. This new house has been a center of much interest ever since its owner's return from Europe in August of this year, and particularly during the past week subsequent to the demise of the great "rail king." The building is still far from completion, however, in relation to its ultimate architectural construction. The architects for the work are Carrere and Hastings, of New York, and the consulting engineers are Hollis French and Allen Hubbard, of Boston.



Main Entrance.

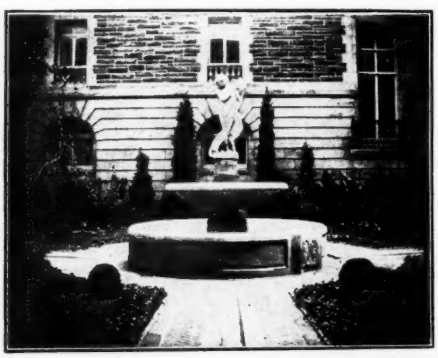


Terrace and Swimming Pool.

THE HARRIMAN RESIDENCE AT ARDEN, N. Y.

The Harriman residence is located in the Ramapo Mountains, about forty-five miles north of New York city, the nearest railroad station being at Arden, on the Erie system. A driveway about five miles long forms the only approach to the house for vehicles, but to facilitate access to the estate an inclined railway has been installed from the foot of the mountain to a point a few hundred feet from the house. This railway is 3,300 feet long, and attains a rise of about 800 feet in its run, the house itself being about 1,300 feet above the level of the sea. At present the inclined railway is operated by a steam hoisting engine, but it is planned to replace this by electricity as soon as practicable. The house is a granite structure, with limestone trimmings, and is to be 336 feet long by 192 feet wide when completed, the general shape being that of a square central portion with an inner courtyard and wings containing chambers, hallways and quarters for the servants.

The electrical service of the house includes lighting, heating, cooking, motor applications, telephone systems and call-bells. In general, the first floor contains an entrance, with brush-up rooms, music room, living room, reception and dining rooms, refrigerating room, kitchen, pantries, and in one wing, quarters for the large staff of servants employed about the premises. A courtyard, about forty-five feet square, with a fountain in the center which is provided with electric conduits, is a special feature of the establishment adjoining the first floor. On the second and third floors of the residence are all the chambers, with a temporary library. Upon the completion of the house, according to the plans now under construction, a large library was to be set apart on the second floor, with offices for the owner and his secretaries. At present the house contains about 100 rooms. The grounds surrounding it cover over 20,000 acres.



COURTYARD AND FOUNTAIN. HARRIMAN RESIDENCE, ARDEN, N. Y.

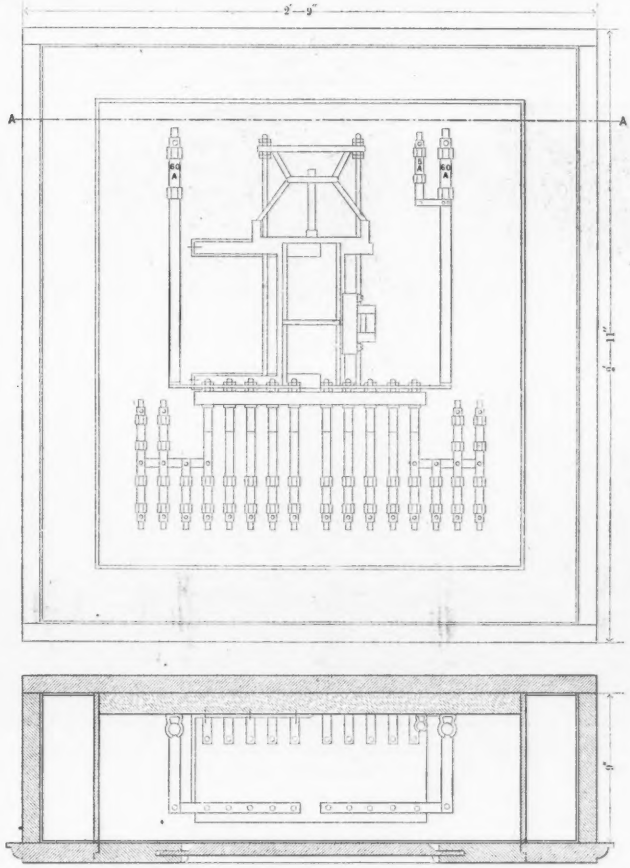
The chief interest of the house, from the electrical point of view, at the present time arises from the careful provision which has been made in the wiring to enable future requirements to be met. As yet no power plant has been designed for the estate, although this work will probably be under way before long, depending upon the desires of the owners. Service is now provided by a temporary installation of a forty-kilowatt, 220-volt, direct-current generator. The house is wired for lighting on the three-wire system. An underground conduit has been provided outside the house for a short distance, so that when the power station is built the cables can be carried into the basement of the residence without obtrusiveness. Eight cables of 1,000,000 circular-mil cross-section each have been provided for connection with the future power house. This large size was selected on account of the unknown distance of the station from the house and the possible extensions of load within the residence which would later have to be carried without undue drop in voltage. About 1,200 incandescent lamps of sixteen-candlepower size are installed at present, but the ultimate installation will probably call for the installation of at least 4,000 lamps in and about the house and grounds. All rooms have been provided with electric-lighting facilities in an unusually liberal manner. The main switchboard of the residence has been designed to control a maximum of about 8,000 lights.

All motor service in the residence is wired on the two-wire system, for operation at 220 volts. At present only a small part of the anticipated power service is under contract, but the house is wired for motor applications as follows:

Laundry.—One five-horsepower motor, to drive two washing machines; one three-horsepower motor, to drive an extractor; one one-horsepower motor, to drive a mangle.

Drying Room.—One one-half-horsepower motor, to drive two fans.

Cleaning Installation.—One seven-and-one-half-horsepower motor, to drive a Spencer four-sweeper vacuum cleaner.



FRONT ELEVATION AND SECTION AT A-A OF EMERGENCY CABINET CONTROLLING TEN LIGHTING CIRCUITS.

Elevator.—One ten-horsepower motor, to drive an Otis elevator, having capacity of 1,000 pounds at 150 feet per minute.

Refrigerating Plant.—One ten-horsepower compressor motor, to drive a six-ton Brunswick ice machine, a one-horsepower motor, to drive brine pump.

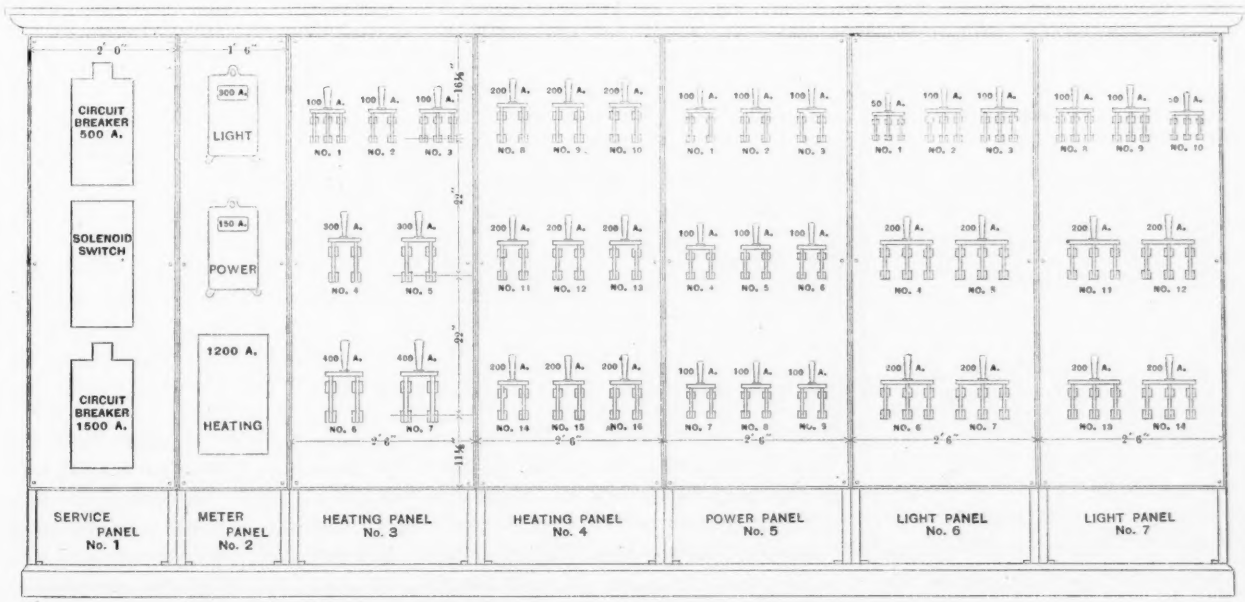
Music Room.—One five-horsepower motor in attic, to drive Aeolian main organ and echo organ blower.

Deep-Well Pump (Future Plan).—One fifteen-horsepower motor, to drive pump for 1,100 feet deep well.

At the present writing the drying room, organ, vacuum cleaner, elevator and refrigerating plant motors are either installed or under contract, representing about sixty per cent of the anticipated power installation.

The center of distribution for the house is at a switchboard located in the basement under the laundry. This board is a blue Vermont marble installation of seven panels, the total length being sixteen feet. It was built by the H. Krantz Company, of Brooklyn, N. Y. There are two lighting panels, a power panel, two heating panels, a meter panel and a service panel. For the power service a 150-ampere watt-hour meter has been installed, with a 300-ampere watt-hour meter for lighting and a 1,200-ampere instrument for recording the electrical energy used in heating. These are all the instruments on the switchboard, but the latter is equipped with a full line of Noark enclosed fuses, mounted on separate marble bases on the back of the board, with two circuit-breakers on the front of the service panel and also a bus-joining solenoid switch which is arranged to throw the lighting and power busbars together in multiple when desired, in case it becomes necessary later to operate the two classes of service independently for most of the time. The watt-hour meters are of the Thomson recording type, and the solenoid switch, which is only one of several of this type installed on the premises, is of Price-McKinlock manufacture. The circuit-breakers are of the Cutter I-T-E type.

From the switchboard the wiring is run in iron conduits to various junction boxes



FRONT ELEVATION OF SWITCHBOARD IN HARRIMAN RESIDENCE, ARDEN, N. Y.

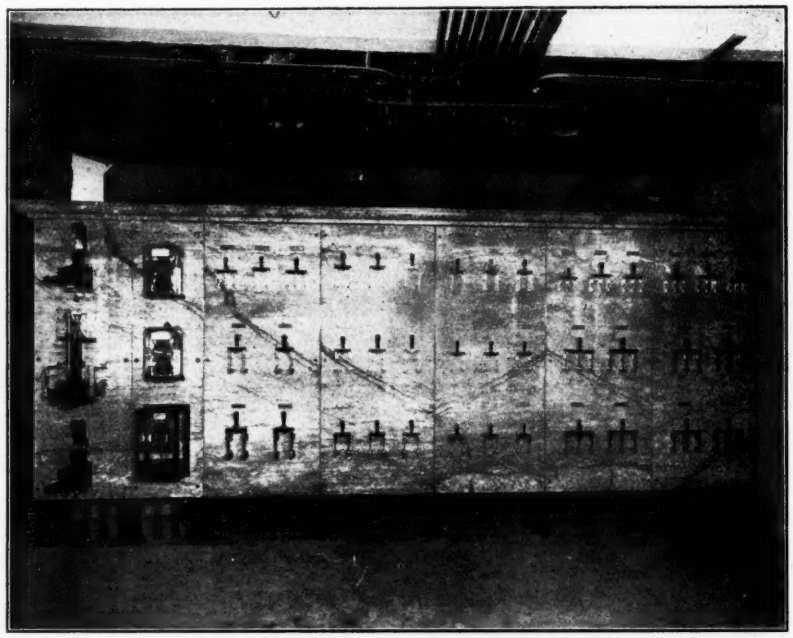
which are employed as distributing centers for their respective service. All wiring above the basement is concealed in the walls or floors. There are no pipe shafts in the house, which makes the wiring somewhat less symmetrical than is possible in office buildings and other large structures where there is considerable duplication of floors and services. Ceiling, wall and floor outlets have been liberally installed, however, to meet any probable demand for any kind of electric service. A special feature of the house is the installation of a separate extra pipe conduit line from every room in the establishment to the basement. This was done at the request of the owner, to anticipate any unforeseen future need of such a service. In the basement the main conduits are run exposed. The house has concrete floors, and is of fireproof construction throughout. The following circuits have been run from the switchboard for power service:

Service.	*Number of Conductors.*	*Size B & S.*
Refrigeration	2	4
Elevator	2	4
Laundry	2	4
Vacuum cleaner	2	6
Organ	2	6
Attic fan, in case of need	2	8

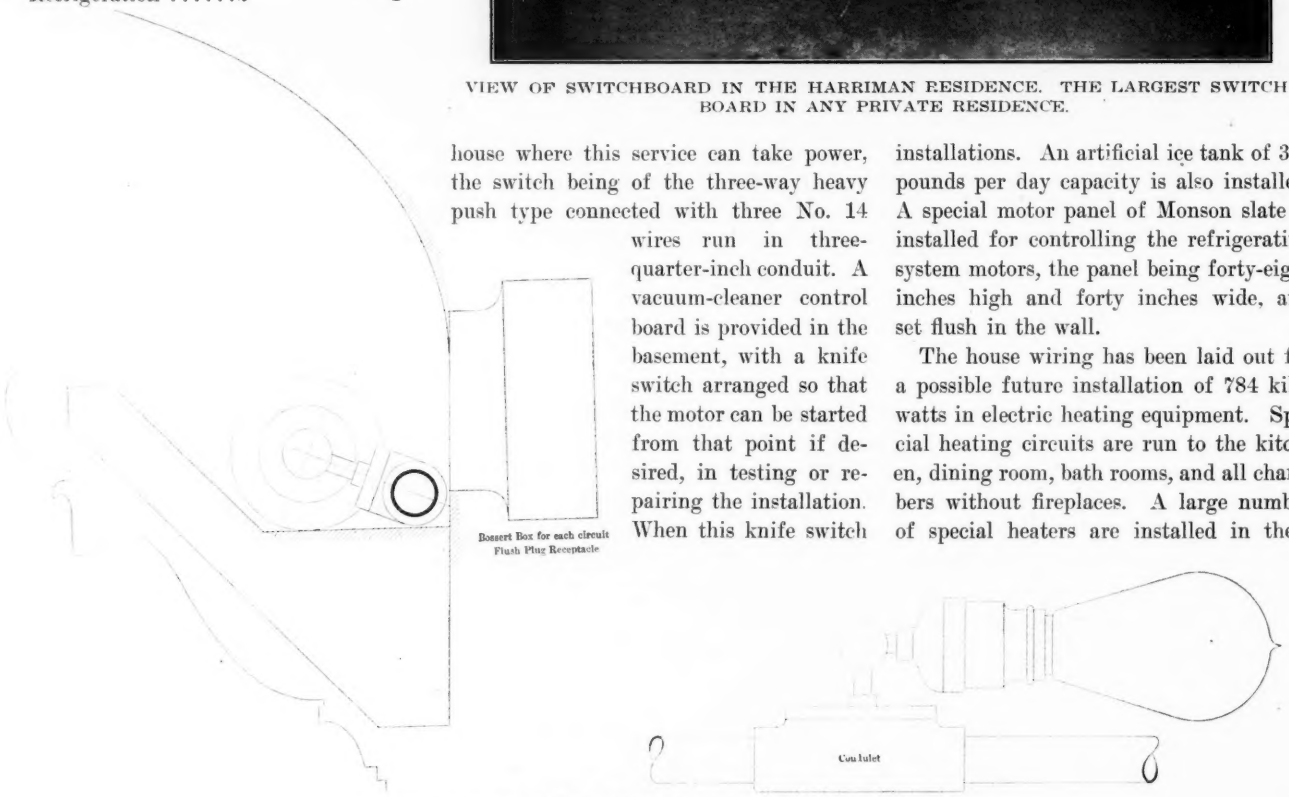
All the wiring was installed by the Attix-Perry Electrical Engineering Company, of Brooklyn. The cabinets contain slate junction boards with busbars and connections for enclosed fuses, with a branch for each circuit. A special feature of the vacuum-cleaner wiring is the provision of a switch at each outlet in the house where this service can take power, the switch being of the three-way heavy push type connected with three No. 14 wires run in three-quarter-inch conduit. A vacuum-cleaner control board is provided in the basement, with a knife switch arranged so that the motor can be started from that point if desired, in testing or repairing the installation. When this knife switch is open it is impossible for the motor to start by the action of any one elsewhere in the house, and tests can thereby be made at leisure.

The refrigerating plant consists of four separate compartments, arranged for the storage of vegetables, fruit, milk and meats. These compartments are provided with plate-glass shelves and walls, with silver-plated white metal fittings, and are electrically lighted. The cooling is effected by overhead brine coils, and the pantries are also provided with brine-coil installations. An artificial ice tank of 300 pounds per day capacity is also installed. A special motor panel of Monson slate is installed for controlling the refrigerating system motors, the panel being forty-eight inches high and forty inches wide, and set flush in the wall.

The house wiring has been laid out for a possible future installation of 784 kilowatts in electric heating equipment. Special heating circuits are run to the kitchen, dining room, bath rooms, and all chambers without fireplaces. A large number of special heaters are installed in these chambers and in the private bath rooms, for use on cool days, particularly in the spring and fall. In general, the heaters are installed in cast-iron boxes set into the wall flush, with bronze grill covers, the capacity of individual equipments varying from one-and-a-half to six kilowatts.



VIEW OF SWITCHBOARD IN THE HARRIMAN RESIDENCE. THE LARGEST SWITCHBOARD IN ANY PRIVATE RESIDENCE.



DETAILS OF COVE LIGHTING IN RECEPTION ROOM.

The bath-room heaters average two-and-a-half kilowatts, and the chambers average from four to five kilowatts. Heating conduits are run to all the other rooms in the house also. Receptacles for "glow" heaters have also been generally established throughout the house in addition to the other heating outlets. The main heating of the residence is by hot water. It is probable that a combined coal and electric range of about eighteen-kilowatt capacity will be installed in the house kitchen. A separate meter will be provided for this device. At present a total capacity of fifty kilowatts in heating apparatus has been installed.

All the lighting fixtures in the house were supplied by Edward F. Caldwell & Company, of New York. There are numerous wall and ceiling outlets, and practically all the corridors and passageways between rooms are provided with two or three-way switches, so that light can be turned on from any entrance of the corridor or room. In general, all rooms are equipped with Diamond-H flush heater switches. For the lighting of the reception room 108 cornice lights have been provided, the wiring permitting the use of sixteen-candlepower bulbs. These are divided into two circuits, so that half may be turned on at once if desired. These lights are controlled by switches in the walls which in turn operate solenoid switches in the basement, the latter being selected on account of the capacity of the circuits and the desire of the owner to have the equipment take up as little space as possible. Another interesting feature of the electric-lighting service was the provision of a special switch in the owner's room by which he could throw about eighty lamps into service instantly around the house, in case he desired to go about quickly at night. A master switch in the above room controls a Price-McKinlock solenoid switch in the basement mounted in an emergency cabinet about two feet square. This solenoid is provided with multiple contacts, so that ten lighting circuits can be switched in and out simultaneously, the multiple feature being a new one in this type of switch. For this service a one-half-inch conduit is run from each special outlet to be controlled in the principal rooms on the first floor and in the corridors to the basement under the dining room. The solenoid switch is of the double-pole type, with 100 amperes capacity, and it is connected with the master switch by three No. 14 wires run in three-quarter-inch conduit.

The residence was provided with a private Bell telephone line to Mr. Harriman's New York office and a local line to the nearest Bell exchange, the service being handled by the New York Telephone Company. All the guest rooms are equipped with jacks for plugging into a trunk line leading to the butler's pantry in the residence, whence connection can be made with the long-distance Bell lines. Three twenty-pair cables for telephone service are run from a junction board in the basement to the principal distributing centers in the house, each instrument being at the end of a private line. In addition to the Bell service, a forty-station intercommunicating system has been installed by the S. H. Couch Company. The sets are fitted with long-distance transmitters and watch-case receivers, all the wiring being composed of cables built up of twisted pairs of rubber-covered wires, taped and braided after being laid. Each cable to an instrument has four No. 16 wires, the rest being No. 19 wires. The conduit for this service was installed large enough so that all rooms could have separate lines to the junction board in the basement. All outlets in the chambers are located in the baseboards. Besides the telephone service, a complete system of call bells with Holtzer-Cabot annunciators is in service.

Reparation in the Case of Differential Rates on Freight Classification.

An order has been issued by the Interstate Commerce Commission for reparation to be awarded to the Otis Elevator Company, in its claim against the Chicago Great Western Railway Company et al., covering two carload shipments of tee rails, or elevator guides, shipped by the company over the line of the defendant from Chicago, Ill., to Portland, Ore. One shipment moved September 24, 1906, and weighed 42,560 pounds, but this claim was not considered by the Commission, for the reason that the railroad company pleaded the statute of limitations against the claim, as it was not filed within the two-year period. That claim was therefore dismissed, but with regard to the second shipment, forwarded September 24, 1906, at destination the Northern Pacific Railway Company, the delivering carrier, collected freight at the rate of $1.40 per 100 pounds. The complainant contended that the rate should be seventy-five cents, and they asked for reparation for the extent of the overcharge resulting as the difference between those two amounts.

Transcontinental Freight Bureau tariff, I. C. C. No. 376, effective January 8, 1904, and in force on the date of the shipment, named a rate of $1.40 per 100 pounds, in carloads, minimum weight 24,000 pounds, from Chicago, Ill., to Portland, Ore., on machinery and machines, taking Class A rates as specified under the head of "machinery and machines," in current Western Classification. The rate collected on the shipment was assessed under the provisions of the tariff.

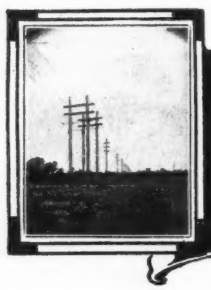
Supplement No. 29 to said tariff, effective April 10, 1906, and in effect on date of shipment, published a rate of seventy-five cents per 100 pounds, in carloads, minimum weight 30,000 pounds, from Chicago, Ill., to Portland, Ore., on iron and steel articles, and Supplement No. 45 to the tariff above referred to, effective August 10, 1907, named a specific rate of seventy-five cents per 100 pounds from Chicago, Ill., to Portland, Ore., on elevator guides, in carloads, minimum weight 30,000 pounds.

The claim was presented informally to the Commission, and at that time, April 23, 1908, the general freight agent of the Northren Pacific expressed the opinion that the tee rails or elevator guides referred to were entitled to the seventy-five-cent rate. Subsequent to the filing of the answers in this complaint, the rates on tee rails or elevator guides were raised from seventy-five to eighty-five cents in carloads, and both the defendants admitted that eighty-five cents would have been a reasonable rate to apply on the shipment, and the Northern Pacific expressed itself as being willing to settle on the seventy-five-cent rate if the Commission should hold that the tariff in force at the time the shipment was made, made that rate applicable. The Commission held this view, and reparation will be made on the basis of seventy-five cents.

A. F. T.

Electric Steel Industry in South Africa.

In a recent report, Mr. Kotze, mining engineer to the Transvaal Government, advises the establishment of a bounty system, similar to that of Canada, in the Transvaal iron and steel industry. It appears that there is a profitable field for the products of electrical steel furnaces which can turn out high-class steel with a comparatively small output per kilowatt-hour. Engineer Kotze proposes that the Transvaal Government share the cost with the Central South African Railways on the £1 for £1 basis of establishing an electric furnace.



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

LUB RICATING AND ELECTRIC BRUSHES FOR COMMUTATORS AND COLLECTOR RINGS.

BY E. O. SCHWEITZER.

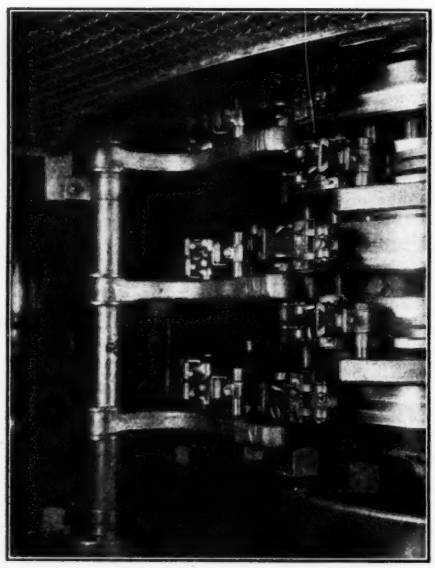
When two surfaces bear against each other and have relative movement, wear results. The elements determining the amount of wear are: relative hardness of the two surfaces, the bearing pressure, the smoothness of the surfaces, and the relative velocity of one surface to the other.

Wear can be largely reduced by sufficiently polishing the surfaces and by applying a lubricant between them.

With collector rings there are usually two metal elements. With commutators the stationary element is usually carbon, but dry carbon contains cutting particles and the commutator must, therefore, be lubricated.

With mechanical bearings, one element can usually be made of anti-friction metal, and it is usually easy to apply sufficient oil to prevent cutting. The conditions are different, however, with two rubbing surfaces which are in electrical contact. With collector rings it is necessary to use copper brushes which are nearly or quite as hard as the ring itself, while on commutators it is necessary to use brushes with certain resistance characteristics and this determines their hardness. A further difficulty in lubricating these surfaces lies in the fact that very little oil may be applied, for oil soaks into and rots the insulation on the machine and collects under the brushes, where it picks up dirt, etc., which in turn getting under the brushes aggravates the condition which the oil was applied to alleviate. Furthermore no successful method of constant application of a very small amount of oil has been found. Oil also in the small quantities in which it is permissible is not a proper lubricant.

The problem of lubrication of commutator and rings is, therefore, a serious one. If commutators and rings are to be allowed to wear away, there is a high maintenance cost as well as an additional first cost of apparatus; for rings and commutator must be liberally enough designed to allow of some of the metal being removed in resurfacing them without reducing the rating of the machine after the resurfacing is done. The cost of resurfacing is a large item (a prohibitive one in small towns) and in addition the



SHOWING BRUSHES WITH CARBON-PASTE LUBRICATING DEVICES, APPLIED TO RINGS OF VERTICAL 2,000-KILOWATT ROTARY CONVERTER.

electrical efficiency of the bearings is very greatly reduced when the polish has been destroyed. Moreover, the noise accompanying the operation of a machine whose commutator or rings are allowed to cut is a very serious objection in any station for obvious reasons.

Many methods have been tried for lubricating commutators and rings, the most familiar probably being the "oily rag" method. The objections to it are so well known that it is hardly necessary to enumerate them. The remedy is intermittent only; it is applied generally after the mischief has been done and does not prevent its recurrence; if enough oil is applied at one application to keep the parts quiet for any length of time, so much is put on that it collects under brushes and soaks into the mica insulation of the commutator and, generally speaking, does more harm than good. In fact, about the only good accomplished is in keeping the rings and commutator quiet for short periods after its application..

Another method of applying oil is to soak carbon brushes in it and to place enough on the commutator and rings so that the entire surface is covered as the machine rotates. The objections to this are practically the same as the oily rag scheme. If the brushes are sufficiently saturated to furnish oil for any length of time, too much is applied at first with consequent soaking of mica and collection of oil under the other brushes. There is the additional objection that when the brushes become warm the oil fries out and leaves the brush dry, which, of course, destroys its lubricating qualities.

Recently the use of dry graphite brushes has become somewhat general. This is a step in the right direction for graphite is an excellent lubricant for commutators and rings, and the use of these brushes materially decreases the abrasion of them. The method of application, however, is faulty. In order to get the lubricant on to the rings or commutators it is necessary for the rings or commutator to wear some of the graphite off the brush. This gives a dry powder which has practically no tendency to adhere to the surface and which is easily blown away by the air blasts caused by the revolving parts. Furthermore, graphite in this form is expensive and doubly so since it is not efficient.

Very finely divided graphite of the unctuous variety mixed with a small quantity of oil and applied with a rag or brush has been found to give very good results, but, of course, the method of application is open to the same objections as the oily rag method. A scheme for applying the graphite paste has been adopted by the Commonwealth Edison Company, of Chicago. The method is essentially the grease cup plan modified so that it can be applied to electrical devices. A copper or brass block is cut

to a size to fit a standard direct-current brush holder and bored out so as to form a cylindrical space into which a piston can be accurately fitted. It is then shaped so that below the cylinder a carbon brush can be attached to the block and soldered. A cover is fitted oil-tight on top of the block, and a threaded shaft, on end of which the piston is fastened, is passed through a hole threaded to receive it in the cover. By means of a thumbscrew on the end of the shaft the piston position can be varied.

In its application the completed brush is fitted to the commutator or collector ring, like an ordinary direct-current carbon brush. A narrow slot is then cut into the carbon and leads up to the cylindrical space in the copper block. The piston and cover being removed the space is filled with graphite paste and the piston and cover are replaced. The brush is then placed in an ordinary direct-current brush-holder and kept on the commutator or collector rings by spring tension. An occasional twist of the thumbscrew presses the graphite into the slot in the carbon when it gradually feeds itself to the rings or the commutator. The illustration shows these brushes applied to the rings of a vertical 2,000-kilowatt rotary converter. Before the advent of the new type of lubricating brush this machine gave constant trouble. All kinds of lubricating devices had been tried on its rings, but they cut away badly and the copper dust and grease around it were an unusual nuisance. The cutting is worse on this machine than on most rotary converters because it has no end play. So bad had the rings become that it was considered advisable to turn them down. The cost of this operation would have been about $150, besides keeping the machine out of service for several days. So bad was this cutting that the advisability of installing more of this type of rotary converters was seriously questioned.

With the rings in this serious condition the new type lubricating brushes were installed. The results have been astonishing. The cutting ceased. Grease and copper dust are now practically unknown about this machine. The rings have taken a nice polish, and where they were formerly a continual source of trouble they are now considered the easiest in the substation to keep in condition.

The Spanish government has appropriated $2,000,000 to reorganize and develop the telegraph and telephone services.

Effect of Electrical Transmission.

The statement is frequently made that waterpowers have increased in value since it became possible to transmit power electrically. Charles T. Main, mill engineer and architect, Boston, Mass., points out in a recent paper that to be correct the statement should be modified. Since the introduction of electrical transmission many waterpowers which were before unavailable and valueless, have been developed and become of value, and many others will be in the future, but waterpowers which have been developed and the power used adjacent thereto have, as a rule, not increased in value.

To the generally applied methods of calculating the values of an ordinary waterpower there must be added one or two steps in the process when applied to the determination of the value of a remote waterpower, which may be capable of development with electrical transmission to some market.

To the cost of the development must be added the cost of the electrical apparatus and pole line to a point where the power is to be used, and this is a large item of expense in long-distance transmission. Usually, also, there must be added to the cost of the physical part of the plant a considerable amount for purchasing the right-of-way for pole line, legal expenses, and the cost of financing the scheme.

To the running expenses must be added the fixed charges for the electrical apparatus and pole line, and the cost of running and maintaining the same.

A correction must also be made for the loss of power in transmission. A comparison of the cost of producing and transmitting power can be made with the prices which can be obtained for this power to determine if the development has any value, and whether the development is warranted or not. The price which can be obtained for the power depends largely upon the cost of producing power by steam engines, gas engines with or without producer plants, or in some other way, at the point of delivery.

When used for lighting and railways the power is usually exceedingly variable, resulting in a low power-factor. The conditions are so variable that it is generally useless to attempt to calculate the comparative cost of power produced by steam under such varying conditions. Each case must be worked out to meet the special conditions of the problem under consideration.

The Largest Power Station in Europe.

At the end of this year the largest power station in Europe will be completed at the famous Trollhaetta Waterfalls in Sweden, and 80,000 horsepower of electrical energy will thereby become available for railway, municipal, industrial and other purposes. The station is being built by the state, which has gained possession of a number of other waterfalls besides the Trollhaetta, and has established a special water commission with a view to their exploitation. Near the village of Trollhaetta the Goetaelf gradually plunges downward for a distance of about 1,000 metres, forming thus a dozen waterfalls. A canal has been built which will catch the raging waters at the point where the falls begin and lead them to the power station. The canal, which is about 1,400 metres long, has been blasted out of the rock and will conduct 252 cubic metres of water a second, the calculated velocity of the water being two metres a second. At the end there is a collecting basin, from which the water flows into eight vertical turbine chambers thirty-two metres in depth, and blasted out of the rock. These chambers connect with the power station at the foot of the mountain, in which eight turbines of 10,000 horsepower each are erected. From the power station electric current will be transmitted to a number of cities and villages.

According to *Die Turbine* (Berlin, August 5), when the giant power station is put in operation, a complete change of scenery will take place at the Trollhaetta Falls. While at present 262 cubic metres of water a second are plunging down the incline, only about fifty cubic metres will flow there in future, and in place of the madly rushing waters, which excite the admiration of tourists, the dry and smooth-ground rocks of the river bed will stare at the observer. In the northern part of Sweden the government will also erect a large power station. Considering that Sweden's yearly imports of coal from England for the use of its industries and railways amount to sixty million kroner ($16,080,000), it is not strange that steps toward the utilization of its waterpowers are being taken. Its unharnessed waters still present grandiose natural spectacles which attract travelers from great distances, but in time the engineer will take possession of the waterfalls and make the attainments of modern engineering available, even in the remotest parts of the country.

Assisted Electric Generating Plants.

[The following excellent article, which is replete with good, if debatable, suggestions, is reprinted from a recent issue of the *Manchester Guardian*, a well-known daily newspaper, published in Manchester, Eng. The matter is commented on in one of our editorials.]

The purpose of this article is to outline a scheme under which the electric power of, say, a factory may be derived in part from its own generating plant and partly from an outside source such as a public supply. This arrangement is particularly suitable for adoption where the home generating plant is driven by gas engines, but it is also applicable where steam engines are employed. It is well known that the cost of electric energy is very largely dependent upon the load factor of the generating plant, that is, upon the ratio of its actual to its maximum possible total output for a year. The object of the assisted electric supply scheme is to raise the load factor of the home generating plant by running it at approximately full load during working hours, the peak loads being carried by means of current from the outside supply. This would involve a very irregular demand on the public supply from the individual consumer, and in part this irregularity and the poor (individual) load factor that it denotes would unfavorably influence the central generating station. Where, however, a number of assisted plants were connected to the public supply, the irregularities of their demands would overlap and to a large extent eliminate any detrimental influence.

The load factor of a generating plant affects the cost of power in three ways. The higher the load factor the less are the capital charges per unit or per horsepower-hour, the less are the attendance and repair charges per unit, and the smaller is the fuel consumption per unit. The proportional effect of the first two of these charges is pretty much the same whether steam, gas or oil engines supply the motive power, but the last—fuel consumption—is less influenced in a steam plant than with the other two. Some engineers, reasoning from central-station theory, may be inclined to think that the reverse is true, and that it is in the steam station that the fuel consumpion is most influenced by the load factor. Whether or not this relation would hold in the case of central stations we need not argue here, for in any case the conditions are different. In the central station there are a number of generating sets, and the engineer in charge varies the number in operation, so that each is running at nearly full load, and therefore at nearly maximum economy. On the other hand, the stand-by losses due to banked fires, leakage, and radiation are more serious in steam than in gas plants. Hence it is arguable that a low load factor is especially detrimental to the economy of a central-station steam plant. But in the case of a small factory plant it is seldom possible to adjust the number of engines in use to suit the fluctuations in load, and the average load is, therefore, considerably below full load. In the case of gas and oil engines this means a much greater falling off in economy than with a steam engine, and, further, there being no stand-by plant, the advantage to the gas engine from this cause does not appear. For instance, suppose that the average load is fifty brake-horsepower, and the maximum eighty brake-horsepower, the gas engine must then be capable of supplying continuously eighty-five brake-horsepower, so that its average load would only be fifty-nine per cent of its rated full load, and its gas consumption per horsepower would be about twenty per cent greater than at full rated load. On the other hand, eighty-five brake-horsepower could be carried by a steam engine of which the normal full load was not more than sixty to sixty-five brake-horsepower, provided an expansion valve was fitted to vary the cut-off. The steam engine would then take the average load at its lowest steam consumption per horsepower, and even if a throttle valve was employed, the extra steam consumption would only be twelve per cent. It is not proposed here to compare the value of steam and gas plants for factory driving, but only to point out that an assisted supply is particularly desirable when gas engines are used. Another argument with the same lesson is the fact that the large gas engine on a small load is not only uneconomical of fuel, but also of capital outlay. Since it has no overload capacity, it must always be bought on the basis of the maximum and not of the average load. Thus in the case stated above, the size of the gas plant could be reduced from eighty-five to fifty-five brake-horsepower, and its price cut down by about twenty-five per cent. Even in the case of the steam engine, there would be a reduction in the capital outlay of from ten to twenty per cent according to conditions.

On the technical side there is no great difficulty in satisfactorily arranging an assisted supply. Where the load at the factory changed only slowly, hand regulation of the factory generator would be sufficient. This would almost always be the case in large factories. Where necessary, however, the proper apportionment of the load could be made automatic. For instance, an automatic reversible booster could be placed in series with the external supply, just as is at present done with buffer batteries on traction systems. With this arrangement power would sometimes be delivered from the factory to the outside supply system, but the meter would, of course, register the net inputs. Another method would be to place the switch on the outside supply under the control of the current from the factory generator, so that the public supply would be automatically switched on as the factory load approached the full load of its own generating plant. Once the outside supply had been switched on some device for maintaining approximately full load on the factory plant would be necessary. A booster could be used or, perhaps more simply, an automatic switch regulating the voltage on the factory generator, so as to maintain an approximately full-load current, the switch being brought into operation by the closing of the outside supply switch, and being governed by the factory generator current. In any case no great difficulty should be experienced in devising satisfactory regulating devices.

It is, perhaps, hardly to be expected that central-station engineers will welcome a scheme which appears to be devised to restrict their motor load; their great aim in life being to increase this class of load. However, it is not at all certain that an assisted supply would not add to, rather than reduce the consumption of current for power purposes; although it may be admitted that the load on the power station would not be quite so steady except in the case of large supply systems. One of the most important considerations with a factory owner or tenant is capital outlay. It is quite certain that many such install electric motors in the first instance in order to avoid the heavier capital outlay which would be required if steam or gas engines were to be employed, and it is equally certain that many factory owners are influenced in their decision not to adopt the electric drive and take current from an outside supply because of the cost of scrapping existing engines, boilers, and producers. Hence, when it becomes necessary to extend their power plant, they are likely to extend it along existing lines. If, however, they are offered a satisfactory assistant supply, they are likely to consider it

favorably. At present, when a manufacturer takes current from an outside supply as well as generates his own, he has to keep the two systems separate, and so loses the advantages of an assisted supply outlined above. Consequently the outside supply does not appear to him in its most attractive light, and it stands correspondingly less chance of favorable consideration. An assistant supply should be an integral part of the whole power supply, and, therefore, capable of indefinite expansion until it absorbs the whole system. This, indeed, is what would be most likely to happen in practice. As the existing plant became too small, or worn out, or inconvenient, the factory owner would be strongly tempted to throw more and more load upon the outside supply until finally the conversion would be complete. Indeed, the assistant supply promises to be the thin edge of the wedge which central-station engineers are so desirous of inserting in the power plants of existing factories.

Gas Engines for Small Central Stations.

To the Editors:

In your issue of September 11 I see that you have published a communication from Mr. E. D. Dreyfus discussing the paper on "Central Stations in Towns of Less than 4,000 Inhabitants" that I read at the National Electric Light Association convention in Atlantic City last June.

I can only say I heartily agree with Mr. Dreyfus that gas engines are now, and in the future undoubtedly will become, an important factor in making the small central stations a success.

My paper, as presented in Atlantic City, expressly states that it was solely intended for plants using steam engines and boilers.

I did not attempt to present the facts as to gas-engine equipments for the reason I did not consider that there has been enough specific information on the actual cost of installation and operation, published, to obtain averages which would be of any value in a general paper. I frankly do not think that Mr. Dreyfus' discussion throws any light on the situation. I do think, however, that Mr. Dreyfus is in a position to very materially assist the small station manager by the publication of a paper which will contain somewhat of the same data on gas engines which I attempted to incorporate in my own paper on steam-operated plants.

James S. Knowlson.

Schenectady, N. Y., September 13.

Trade Journal Enterprise.

The Iron Trade Review, of Cleveland, Ohio, has set the pace for trade journalism by publishing a daily issue which will henceforth appear every day of the business year except Wednesdays, when the regular weekly edition is issued. A special feature of the daily publication is the complete system of daily market quotations in the metal trades, this being the principal reason for the new departure.

Association of Edison Purchasing Agents

At a meeting of the Association of Edison Purchasing Agents, which took place at Briarcliff Lodge, Briarcliff Manor, N. Y., the following officers were elected:

President—H. C. Lucas, purchasing agent, Philadelphia Electric Company, Philadelphia, Pa.

First vice-president—W. H. Francis, purchasing agent, Edison Electric Illuminating Company of Boston, Boston, Mass.

Second vice-president—J. W. Brennan, purchasing agent, Edison Illuminating Company, Detroit, Mich.

Secretary—H. F. Frasse, purchasing agent, Edison Electric Illuminating Company of Brooklyn, Brooklyn, N. Y.

Treasurer—Andrew Banks, Jr., purchasing agent, Consolidated Gas, Electric Light and Power Company, of Baltimore, Baltimore, Md.

Stock controller—J. J. Miley, purchasing agent, Minneapolis General Electric Company, Minneapolis, Minn.

The meeting took place at the same time as the convention of the Association of Edison Illuminating Companies, and several new members were enrolled. At the present date the roster covers about thirty-five per cent of Edison illuminating companies. The purpose of the association is for general information and to induce friendly business intercourse.

A School of Aeronautics.

A higher school of aeronautics has been established in France. The new school, which is due to the conception and efforts of Commandant Roche, will be concerned with the practical side of aeronautics and aviation, and the pupils who succeed in passing its examinations will receive the title of aeronautical engineer. The course will last a year, and the lectures will be devoted to all the principal branches of aeronautics and aviation, including motors, while additional lectures will be given on subjects concerned with the progress and evolution of aerial navigation.

Protection Demanded for Linemen.

A petition signed by electrical workers of South Bend, Ind., says the *Telephone Engineer,* of Chicago, has been filed with the City Council, asking for the improved methods in electrical construction and better protection for the linemen.

The petition asks that all high-tension wires be placed on yellow cross-arms; primary and arc-light wire on black cross-arms, and low-voltage wires, such as telephone, telegraph, police and fire-alarm, on red cross-arms. Where high and low-voltage wires are on the same poles, the petition asks that a clearance of six feet be made.

Cross-leads are recommended to have a clearance of four feet with proper guards. High-voltage wires should be placed on the tops of the poles, and no street-railway lines should carry more than 1,000 volts on their wires. The petition cites the great number of incidents where electric workmen had been electrocuted and little or nothing had been done to better conditions.

Electrically Driven Kneaders.

The Syndicate of Bakers, of Paris, has made comparative tests of fourteen mechanical kneaders. The measurements of the power consumed were made by Mr. Ringelmann and communicated by him to the French Academy of Science. Each batch of dough weighed 172.75 kilogrammes and was of the same composition. The total mechanical work necessary for one kneading varied from 19,476 to 165,380 kilogramme-metres, according to the system employed, and the maximum power required at the end of the operation varied from 0.41 to five horsepower. Knowing the power at no load, which was from 1.75 to 32.42 kilogramme-metres and the time required for the operation (from six to fifteen-and-one-half minutes), it was found that the work expended for kneading 172.75 kilogrammes of firm dough was from 16,664 to 175,983 kilogramme-metres, according to the machine. The kneaders considered as excellent in all respects by the commission required from 44,400 to 58,000 kilogramme-metres for one kneading. For kneaders driven by electric motors the cost of electrical energy calculated on the basis of the rate in Paris (0.3 franc, or six cents, per kilowatt-hour) amounted to 0.06 to 0.08 franc per kneading—much less than kneading by hand, which is not as sanitary, and does not give bread of as good quality as mechanical kneading.

The New Power House for the Capitol Buildings in Washington.

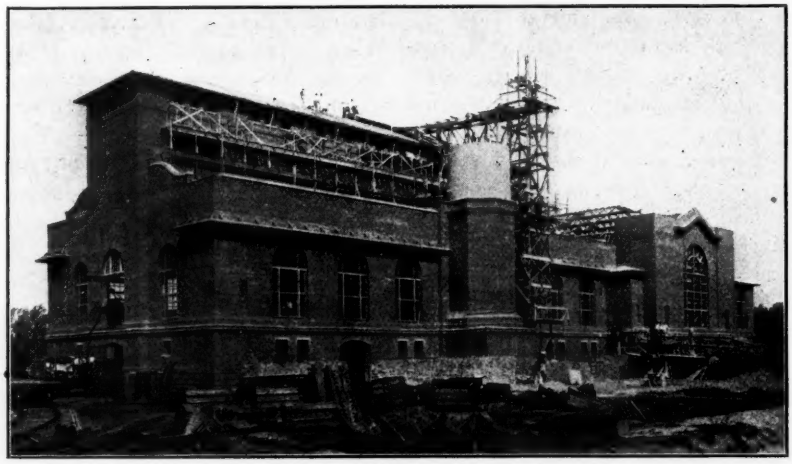
The Federal Government at Washington, D. C., is erecting a large central power house which will supply light, heat and power for the Capitol, the office buildings for the House of Representatives and the Senate, the Congressional Library, and possibly the new Supreme Court Building, when this long-deferred structure is provided for. This plant has been under construction for some time, and, as seen in the accompanying illustration, is rapidly nearing completion.

The plant is located on Capitol Hill in the plot of ground known as Garfield Park, near the intersection of Virginia and New Jersey avenues. The building is about 3,000 feet from the Capitol, and is connected with it and with the other buildings referred to by tunnels through which the steam pipes and electric cables run. Seven thousand feet of tunneling was necessary to connect the various buildings with the plant. These tunnels are large enough for a man to walk through, and are sectionalized so that in case of a breakdown the trouble can be located and isolated without interrupting the service.

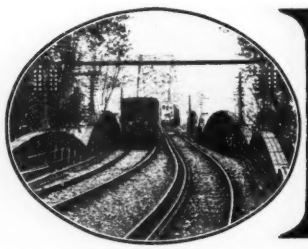
The equipment of the plant will be very complete. The Government is sparing no pains in selecting the latest machinery so as to make the plant one of the finest of its kind in the world. There are already installed sixteen 500-horsepower boilers. In the group of four buildings to be supplied from this central plant there are 46,000 sixteen-candlepower incandescent lamps already in use. These are divided as follows:

Congressional Library, 8,000; office building of the House of Representatives, 10,000; office building of the Senate, 8,000; Capitol Building, 20,000. In addition to these incandescent lamps there are distributed throughout the Capitol grounds about 150 arc lamps.

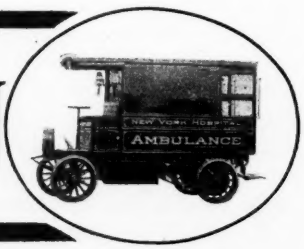
The corner-stone of the power house was formerly the base stone of the Greenbough statue of George Washington, which stood for many years on the plaza of the east front of the Capitol but was recently removed to the Smithsonian Institution. The power plant, when completed, will cost very nearly $2,000,000.



THE GOVERNMENT POWER PLANT AT WASHINGTON, D. C.
Construction View, Taken August 25, 1909.



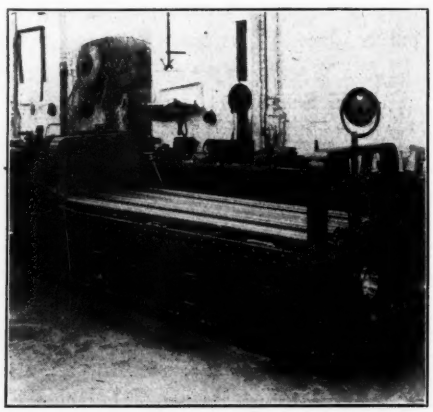
ELECTRIC TRACTION



Novel Electric Storage-Battery Locomotives in German and Austrian Mines.

Throughout Germany and Austria-Hungary there are a number of mines which have been equipped with storage-battery locomotives of the unique construction shown in the accompanying illustrations. The batteries are mounted on the top and are removable for charging. The gearing for this purpose is of special design, with permanent rolls fixed in the locomotive frames directly above the truck. By providing this equipment it is possible to shift the discharged batteries and replace them on the locomotive with fully charged sets with a minimum expenditure of time and labor in making the exchange.

These German storage-battery mining locomotives are equipped with motors of from eight to thirty-two horsepower capacity and each locomotive is provided with two sets of batteries when uninterrupted service is required. One of these is being charged in the charging room while the other is operating the locomotive in the mine.



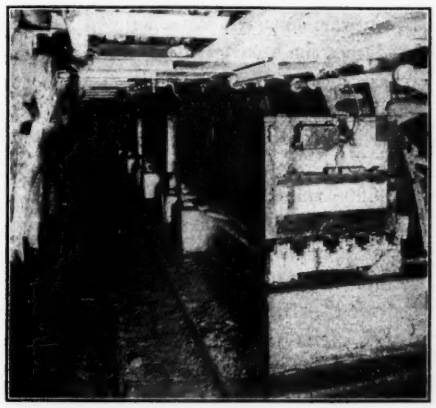
STORAGE-BATTERY MINING LOCOMOTIVE WITH BATTERY REMOVED.

It is stated that the storage batteries used are seldom discharged more than sixty or seventy per cent of their capacity and it requires for charging only about one-third of the time usually taken for discharging in operating in the mines. When partially discharged the batteries may be fully charged in about one-and-a-half hours.

The mining locomotive of this type of twenty-horsepower capacity has two batteries of ninety cells each, the capacity of each being seventy-four ampere-hours. They are capable of operating 400 effective ton-kilometres on a single charge. When two storage batteries are employed with a smaller locomotive the cost is about 1,200 marks, or $300, per horsepower, while for the larger locomotives the cost

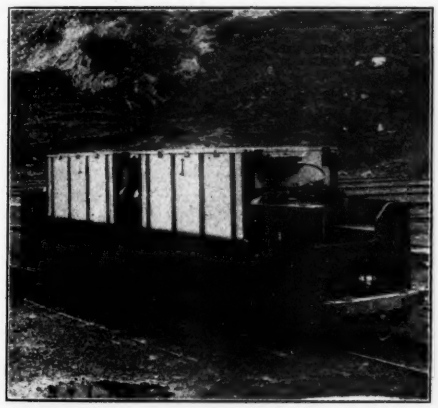
is considerably less, being nearer to $200, or 800 marks, per horsepower.

The cost of operation for these locomotives is from one-third to one-half the cost of animal power, it is claimed, and the current required is from one-fourth to one-third kilowatt-hour per ton-kilometre. One advantage of these equipments over the trolley and third-rail mining locomotive is that no added weight is needed for adhesion, as the storage battery provides all the necessary weight required.



CHARGING TABLES FOR LOCOMOTIVE BATTERIES IN THE MINE.

One of the accompanying illustrations shows the battery-charging tables at Shaft II of the Konigsborn Aktiengesellschaft. There are five battery locomotives at these mines near Heeren in Westphalia, one of which is shown in the shops. At this mine there are provided eight storage batteries, each having eighty-one cells of a capacity of seventy-four ampere-hours.



DOUBLE-UNIT STORAGE-BATTERY MINING LOCOMOTIVE.

There is no doubt that the storage-battery locomotives have some marked advantages over those operated by overhead trolleys or third-rail conductors. They are thoroughly reliable and without question less dangerous to the miners, as they eliminate the need of any exposed conductors. They also have a large radius of action without extensive overhead construction.

In the Hungarian Petroseny mine there are eight storage-battery locomotives in operation of the type shown in the lower illustration, each having a capacity of twelve horsepower. These locomotives of the Zalgo-Tarjaner Kohlen-Bergbau Aktiengesellschaft are operated in pairs. The double units thus formed are capable of hauling forty coal cars without difficulty.

STORAGE-BATTERY MINING LOCOMOTIVE IN SERVICE.

At this mine there are used sixteen sets of batteries. The Tudor type of cells are employed as built at Budapest by the Tudor Accumulatoren Fabrik Aktiengesellschaft. Each locomotive has fifty-one cells, with a capacity of seventy-four ampere-hours each.

Long Island Road to Issue $16,500,000 Debentures.

The Long Island Railroad has made application to the New York Public Service Commission to be allowed to issue ten-year four per cent debenture bonds to an amount up to $16,500,000.

These bonds are to be delivered to the controlling company, the Pennsylvania Railroad, to reimburse it for advances made for improvements on the Long Island. To date, the Pennsylvania has loaned its subsidiary $6,062,956, and it is planned to advance about $10,500,000 more when these debentures have been authorized. The Long Island is paying the Pennsylvania four-and-one-half per cent for money, so that more than $30,000 a year will be saved by the refunding in interest charges on the money owed the controlling road as of December 31, last. The latter owns 135,958 out of the 240,000 outstanding shares of the Long Island Railroad.

In the last four years, from 1905 to 1908, inclusive, the Long Island has spent a total of $14,427,951 on improvements.

Electrification of Australian Railways.

The suggestion for electrifying the Melbourne suburban railway system, as recommended by Charles H. Merz in a special report to the Victorian Government, has not been favorably received by the Victorian Railway Commissioners, as is now well known.

However, the magnificent success achieved by the conversion of the Sydney suburban system, according to the *Electrical Engineer,* London, refutes the Victorian Commissioners' arguments that electrification would not pay in Melbourne. On June 30, 1908, the New South Wales State Tramways had cost $16,442,500, and they showed a net gain of $357,500, after paying all working expenses and interest on capital. The steam lines, with a total length of 43.25 miles, belonging to the state, are run at a net loss of $15,500 a year. The New South Wales Railway Commissioners announce that they mean to electrify all their steam lines at an early date. During the past nine years, since the inception of electrification, the length of line has increased about eighty per cent at an outlay of double the original capital, and three times the original number of passengers are carried. The interest return on the capital invested has risen from four to nearly six per cent. The total length of single track operated by electricity is 146 miles. The substitution of electric power for steam has been successful in every respect, and the most important result of the change is not seen in the figures—namely, the extension and development of the city of Greater Sydney. The fares are charged on penny sections, about one-and-one-half miles each, and workers can live a long way from their work, in better houses with more land, amid fresher air. The Sydney railway authorities contemplate a complete metropolitan scheme of underground electric traction, designed to help the future development of the city.

With the Sydney example staring them in the face, it is extraordinary that the Victorian Railway Commissioners should object to electrification. Unfortunately they are all three of them steam-railroad men, with no knowledge of electric traction, so the expansion of the great city of Melbourne and the convenience of its citizens must await the advent of more modern railway experts.

Transportation Arrangements for Denver Convention.

Transportation arrangements for attending the annual convention of the American Street and Interurban Railway Association, at Denver, Colo., October 4 to 9, have been completed and announced in the form of an attractive folder.

A special train de luxe has been arranged for, consisting of the finest of modern equipments, including a buffet-library car, standard Pullman sleeping cars, dining and observation cars, electric lighted throughout.

This train will leave Chicago, over the Burlington Route, Saturday, October 2, at 2 p. m., and will arrive in Denver Sunday, October 3, at 4 p. m.

Returning trains will leave Denver, at the close of the convention, at 4:15 p. m., 10 a. m. and 9 p. m., arriving in Chicago the following day at 8:45 p. m., 4:30 p. m. and on the second day at 7 a. m., respectively.

The fare, round trip, will be thirty dollars, not including meals or berth. The return on these tickets will be good till October 31.

Reorganization Plan Approved.

The Public Service Commission, of New York, has approved the plan and agreement for the reorganization of the Albany & Hudson Railroad Company submitted by ex-Governor Myron T. Herrick, of Ohio, Clinton L. Rossiter, vice-president of the Long Island Loan and Trust Company, and R. A. C. Smith, president of the American Mail Steamship Company, a reorganization committee representing a large number of stockholders and bondholders of the company.

The plan of reorganization provides for the issuance of $2,100,000 preferred and $1,275,000 common stock, to be exchanged for the present outstanding stocks and bonds. The new company also asked for authority to issue a mortgage of $1,500,000, the greater portion of which is to be used in double-tracking the third-rail system, between Rensselaer and Kinderhook, and the purchase of the bridge connecting Albany and Rensselaer.

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The Dangers of Atmospheric Electricity to Airships.

An approaching thunderstorm is a cause of apprehension to air navigators, for the slightest spark arising in the balloon may cause the burning or explosion of the gas it contains. L. Zehnder states that atmospheric electric discharges are dangerous to the balloon particularly when conducting parts are in or on the balloon, or in its vicinity, and indicates means of preventing their disastrous effects. The space surrounding our earth must be considered as an electric field, in which a difference of potential exists in a radial direction, and it has been shown that this difference of potential varies from 1,000 to 10,000 volts per metre of difference in height, according to the conditions of the weather. Furthermore, during thunderstorms, the electrical conditions of the air are subject to great variations, and the charges may change suddenly in sign. The greater these changes, the greater the danger to the airship. If the latter had the same conductivity and dielectric properties as the surrounding air, the probability of its being destroyed by atmospheric discharges would be very small.

In clear weather an ordinary balloon without metal parts, of large size, is not exposed to any danger so long as it floats in the air, as an equalization of static electricity is effected by the conduction of the balloon material; but upon landing, when the trailing rope touches the ground, the formation of a spark is more likely. Ignition of the gas by electric discharges may take place when the poor conductors constituting the balloon are very wet or when metallic parts are present, those of the valve being the most dangerous. A metal valve will retain a charge as long as it lies on the well-insulating balloon material, but will discharge to any conductor coming near it when the valve is opened and the balloon collapses. Therefore the valve should not be touched while gas is flowing from the balloon, and afterward only when it has been discharged slowly and under suitable precautionary measures. A long trailing rope of well-conducting material is recommended as a suitable protection against explosion upon landing. It is possible that after a shower a portion of the balloon envelope in the vicinity of the valve may be dripping wet and that a spark may form between this portion and the valve.

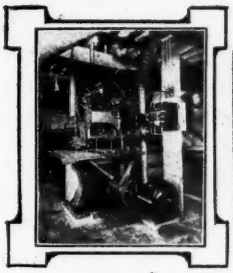
Sudden changes of potential, like those of atmospheric electricity during thunderstorms, are produced artificially in wireless telegraphy, and the sending of wireless messages from a balloon is therefore dangerous. The receiving of such messages, on the other hand, is harmless, as very low pressures are employed in the receiving apparatus. In balloons of rigid or semi-rigid construction with metal frames, like the Zeppelin airship, the conditions for burning are very favorable. According to the above-mentioned measurements, the difference of potential between various parts of a balloon of this kind may be very great, especially when it assumes a slanting position in order to rise or sink. In the Zeppelin airship, with its length of about 130 metres, the difference of potential may amount to 500,000 volts between its ends, while 3,000 volts are sufficient to generate igniting sparks. As protection, the author recommends that either the balloon be provided with projecting points, from which alone the electricity may radiate into the surrounding air beyond the reach of any escaping gas, or else to use thin sheet metal as a balloon envelope. According to electrostatic laws, no sparks could arise in the interior of a balloon thus constructed and static charges would be equalized with facility.—*Abstracted from Elektrotechnische Zeitschrift (Berlin), August 12.*

Electric Locomotive Headlights.

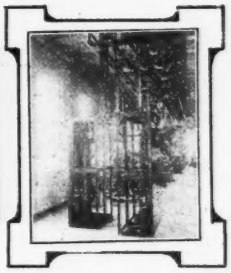
The agitation regarding the compulsory use of electric headlights on the steam railroads in several states has brought forth favorable comment from most of the locomotive engineers that have been called to testify on the matter. Recently in the state of Washington several locomotive engineers stated before the railroad commission that the electric headlight was much better than the acetylene headlight and was the only one that ought to be considered. Its great penetrating power was unexcelled and did not interfere with the reading of signals, as had been claimed by some railroad men.

Further Railroad Electrification in England.

It has been definitely decided to open the public service of electric trains on the newly electrified South London line of the London, Brighton & South Coast Railway on Friday, October 1. The fixing up of the overhead apparatus at the Victoria and London Bridge stations has been completed, and trial trains have been running every night for some time along the whole route.



Industrial Power



Electric-Fan Installation in Bombay Cathedral.

In a climate like India some method of moving the air about is absolutely necessary for comfort, and prior to the advent of electricity this was effected by means of the punkah, a heavy wooden pole slung by ropes from the ceiling and having a piece of cloth about two feet deep attached to it. Sometimes several punkahs would be hung one behind another and linked together by ropes. A coolie would stand outside the room and keep the punkahs swinging by means of a rope passing through the wall and over a pulley.

INTERIOR OF BOMBAY CATHEDRAL, SHOWING ELECTRIC FANS.

Punkahs in India are now largely being replaced by electric fans. The accompanying illustration shows a most artistically arranged electric-fan installation in the Bombay Cathedral. Anyone who has seen the interior of this cathedral when (about a year ago) it was darkened and obscured from view by lines of punkahs swinging about eight feet from the ground will be greatly impressed by the difference the electric fan has made in this case. The illustration clearly shows the brightness and cheerfulness of the interior, and it may well be said that the innovation has added to rather than detracted from the æsthetic effect.

The fans, of which there are sixty-four, were supplied by Crompton and Company, Limited, of London and Chelmsford, England, and were installed by Greaves, Cotton and Company, a Bombay electrical contracting firm. Each fan has a sweep of sixty inches, and the aluminum blades are curved after a pattern finally adopted by the Crompton company after an exhaustive system of experimentation, as affording absolutely silent running and giving the most efficient displacement of air. These experiments were fully described in a paper by L. Murphy which appeared in a recent issue of the *Electrical Review*, of London.

The direct current for the fans is supplied by the Bombay Electric Supply and Tramways Company at a pressure of 230 volts. This company has a three-wire 460-volt direct-current service in the city of Bombay, but in the suburbs and outlying districts the company uses a three-phase, four-wire, fifty-cycle, 230-volt service (400 volts between phases).

The total cost of the installation of the sixty-four fans was approximately $3,000. The current used by the fans is about eighty-five watts per hour, and the cost of working is about $65 per month.

Taking into consideration the extremely low cost of labor in India it is a promising sign that electricity should be displacing native labor which is used for operating punkahs in this part of the world.

Thanks are due to T. D. Parry, of the Bombay office of Messrs. Crompton, for supplying the above information.

The Production and Uses of Ozone.

A paper on this subject by Leon Gerard fills the entire August number of the monthly bulletin of the Société Belge d'Electriciens. The various systems of its manufacture now in commercial use, among them that of the author, are described, as well as a number of large installations for the sterilization of water. The most important industrial, commercial and medical uses of ozone are dealt with in separate chapters, and an extended bibliography is appended to the paper. In conclusion, the author states: "The object of this communication is to show that ozone may now be obtained cheaply and in quantity as an industrial product, and many of its applications that have been abandoned simply on account of its cost are now possible. The immediate employment of ozone for the sterilization of drinking water forms a branch of the electrical industry which will absorb thousands of kilowatts in Europe, for pure and cheap water is an essential element of human existence. The fact that ozone costs ten times less today than ten years ago represents an important industrial progress, which has the double advantage of having an economic and general-utility character in view of its bearing on the public health."

CURRENT-LIMIT CONTROL.

BY E. R. CARICHOFF.

Control of the current input of a motor by the current itself is recognized as superior to any other method of regulating the current input while the motor is accelerating, and the purpose of this article is to explain a few simple diagrams so that anyone can readily see how the control is effected.

It is generally understood that the current-limit device stops the progression of the accelerating devices when the main current exceeds a set value and permits their progression again when the current recedes to the set value. In other words, the current-limit device causes a pause after the main-line contact is closed through the motor and after the withdrawal of each resistance unit and the current curve takes the shape of a series of saw teeth.

The maximum and minimum current values may be made to differ by less than five per cent, although such a small variation is not usual, because it requires a large number of resistance steps. For the same current variation a motor with a series-field winding needs fewer resistance steps than does a similar motor with shunt winding only.

Ordinary conditions of series-motor operation are met by the use of controllers with five or six steps, but exceptional conditions may call for as many as twenty steps. By a five-step controller is meant one with four blocks of resistance, and by a six-step controller one with five blocks of resistance. The current-limit device causes a pause before the withdrawal of each block of resistance.

For series-parallel control of motors ordinarily five steps are used in series with three steps in parallel, or six steps in series with four steps in parallel. For frequent service, such as railway, hoist, and rolling-mill work, controllers are usually built up of a number of magnetically operated unit switches, commonly called contactors, and the contactors forming a controller are alike whether used for making and breaking main-line current or for cutting out or cutting in a block of resistance. They are provided with heavy renewable contact tips protected by magnetic blow-out, and are built so substantially that they may be depended on to operate one million times before requiring renewal of any parts.

As contactors are moderately quick acting, and the time of accelerating a motor is greater than the sum of the fractions of time taken by the several contactors of the controller, it is evident that there must be a pause introduced between the successive operation of contactors.

With a motor always starting the same load on a constant voltage, the pauses may be made fixed intervals of time, but when the load is variable and the voltage also, the length of these pauses must be varied to keep the accelerating current practically constant. This is what the current-limit governor does; the motor does its best, and no more; it takes less time to accelerate for a light load than for a heavy load. On the other hand, with fixed time intervals between the operation of successive contactors, the longest time of starting the maximum load must also be taken for the minimum load, resulting in a waste of time. Even if fixed time intervals were satisfactory, it would be found very difficult to get a device suitable for use with controllers which is capable of affording definite time intervals. The ordinary dashpot furnished for such purposes gives an uncertain interval, and is generally regarded as unsatisfactory.

Fig. 1 shows a circuit diagram for a five-point controller, non-reversing. The master switch K has two running positions. On the first position a maintaining circuit is afforded for all the contactors, which are actuated from the second position of the master switch. When the master switch is thrown at once to second position, the contactors are actuated successively under the control of the current-limit device, but the progression may be arrested at any desired moment by returning the master switch to first position, and the progression may be started again by moving K to second position. Repeated movement from position 2 to position 1 serves to notch up the controller in any desired intervals of time.

The current-limit relay has two independent plungers with bridge pieces closing contacts in the actuating circuits to the contactors when the plungers are down; for lifting the two plungers there are two coils, 8 and 9, the circuit for either of which passes through contacts controlled by the other; and for holding up the plungers there are two main-line coils, CL_1 and CL_2, which are provided with adjustments such that the plungers may be set to drop at any fixed value of current within wide limits.

The contactors are each provided with an interlock switch, whose function is to close the contactor coil upon a maintaining circuit, and then to interrupt the actuating circuit from the current-limit relay, so that the lifted plunger of the relay may be free to fall as soon as the main current drops to the set value. The interlock switch of one contactor also bridges a gap in the actuating circuit for the succeeding contactor.

Referring to the diagram, Fig. 1, suppose the operator's switch K is moved to position 2; the only closed path for the current is from L^1 to 7, through 9,

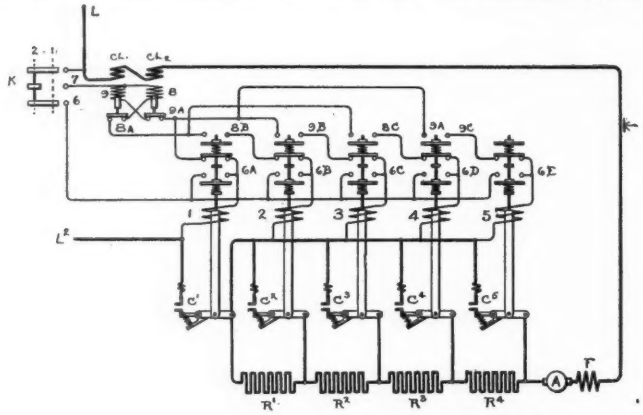


FIG. 1.—FIVE-POINT CURRENT-LIMIT CONTROLLER.

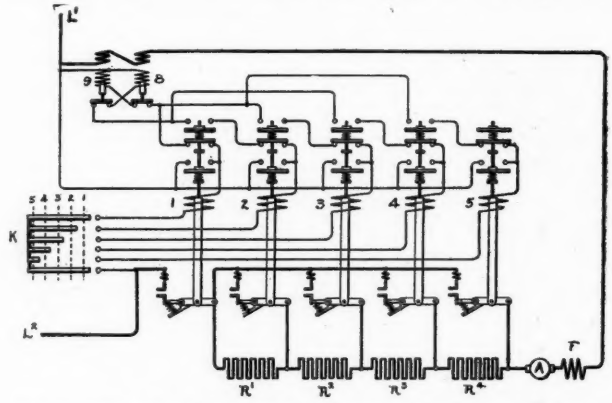


FIG. 2.—CONTROLLER WITH CURRENT-LIMIT AND INDIVIDUAL RUNNING POINTS.

through contacts controlled by 8 to 9A, through interlock contacts of contactor 1 to 6A, through coil 1 to L^2. Contactor 1 now closes contact C^1, completing the main motor circuit from line L^1, through CL_1, CL_2, field F and armature A of motor, resistance blocks R^4, R^3, R^2, R^1, and contact C^1 to line L^2. The interlock of the contactor closes bridge 6 to 6A, connecting the contactor coil to the circuit from wire 6; this interrupts the circuit from 6A to 9A, permitting the plunger of 9 to drop as soon as the main current recedes to the set value, and closes 8A to 8B in the actuating circuit to contactor 2.

As soon as the main current in CL_1 recedes to the set value, the plunger of CL_1 drops bridge 8 to 8A and current passes from L^1 by wire 7 through coil 8, lifting its plunger and bridging contact, through bridging contact on 9 to 8A, thence across bridge closed by interlock of contactor 1 to 8B, through bridge on interlock of contactor 2 to 6B, then through contactor coil 2, and through contact C^1 to L^2. Contactor 2 then closes contact C^2 and cuts out the block of resistance R^1; at the same time it moves its interlock switch, closing wire 6 on 6B and afterward opening bridge 8B to 6B. The increase of current caused by withdrawal of R^1 causes the main current in CL_2 to hold up the plunger of 8 until the current falls to the set value, when this plunger drops, closing 9 to 9A. Current may now pass by 7, 9, 9A, 9B, and 6C to coil 3. Similarly, contactors 4 and 5 are excited.

Fig. 2 shows a controller and operator's switch with individual running points for each of the contactors, 1, 2, 3, 4, and 5.

In cases where an operator has to manage a number of controllers at the same time or wishes to run on definite resistance points this becomes the preferable form. It is readily seen that the controller K may be thrown by the operator to any point desired, and the contactors up to that point will close as fast as the current-limit relay will permit.

As in other cases, the actuating circuit of each contactor, except the first, has a gap which must be bridged by the contactor immediately preceding. If the controller is thrown to position 5, the only controlling circuit is through contactor coil 1 and relay coil 9. Contactor 1 interlock comes up bridging contact in circuit to 2, but this circuit is still open under 9, and is closed only when the main current drops to the set value, when contactor 2 comes up and a pause occurs, then 3 and a pause, then 4 and so on.

Bituminous Producer in Double Role in Sheet-Metal Factory.

A bituminous gas producer for supplying fuel to gas engines, as well as furnishing gas for solder baths and enameling kilns, has been installed by the S. F. Bowser Manufacturing Company, maker of oil storage and distributing tanks and automatic weighing pumps, in its modern factory at Fort Wayne, Ind. This type T Westinghouse producer plant, of 350-horsepower capacity, supplies three 120-horsepower tandem horizontal engines, direct-connected to direct-current generators. These furnish power to the shops, which are motor-driven throughout. The equipment replaced by the present installation comprised three 150-horsepower Scotch marine boilers, equipped with underfeed stokers, supplying steam to fifty-horsepower and 125-horsepower simple engines. In the shops a large quantity of gasoline was formerly used for melting solder, while coke was required for the enameling kilns.

Recognizing the superior economy to be obtained from producer equipment, as well as the advantage of doing away with gasoline and coke in its own special case, the Bowser company decided to install a complete new equipment for gas engines and gas producers. The matter of selecting a bituminous producer was carefully weighed, and members of the firm visited a number of installations throughout the country to study the performance of the types in operation at the present time. The West Virginia coal, 13,000 heat units a pound, used in the producer at present, is delivered at a cost of $2.55 per ton. A Green County, Indiana, coal, of approximately the same heat value, has been successfully experimented with, and will cost, delivered, $2.25 per ton. The installation has been under the supervision of A. A. Bowser.

Cotton Manufacturers to Hold Convention.

The National Association of Cotton Manufacturers will hold its next semi-annual meeting at the Mount Washington, Bretton Woods, N. H., on Wednesday and Thursday, September 22 and 23, next. The sessions will be held in the ballroom of the hotel at 9 a. m. and 8:15 p. m. each day. An interesting list of papers will be presented and mechanical and electric development relating to textile-mill machinery will be given due consideration. C. J. H. Woodbury, International Trust Building, Boston, Mass., is the secretary.

Electrical Developments and Problems in Western Australia.

Electricity is making rapid headway in the Kalgoorlie mines in Western Australia. The second polyphase turbo-generator of 500 kilowatts is now running on the Horseshoe. These generate power for motors all over the surface, and are giving great satisfaction. As the tonnage is now approaching 25,000 tons per month, fifteen new Wilfley tables are being installed to deal with the tube-mill product; and pumps are being erected to pump the concentrate instead of trucking from the tables. For some time past the Government Water Supply Department has been troubled by rapid decay of the cast-iron water mains in Kalgoorlie and Boulder City, and attributes this to leakage of current from the electric-tramway system. In order to test whether electrolysis is going on or not, twenty-two small meters have been set up in the twenty-and-one-half miles of tramways, at regular intervals, and connected with the rails. The test has just started, and will be watched closely.

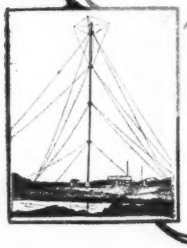
Electric Development in Western Mines.

A dispatch from the Alta mine, of the Boston & Alta Copper Company, Alta, Mont., states that within the next two or three months the present hoist will be replaced by a large engine of modern type, operated by an electrically driven air compressor. This latter will also furnish power to run the drills and pumps. A pole line is being erected to connect with the company's power plant on Prickly Pear Creek, where power will be generated to run the entire plant and also to furnish electric light both on the surface and underground.

In South Dakota, work will soon be resumed on the 2,000-horsepower hydro-electric plant, utilizing the waters of Rapid Creek, near Rapid City. The power will be used in the surrounding mines.

The Electrolysis Situation in Dayton.

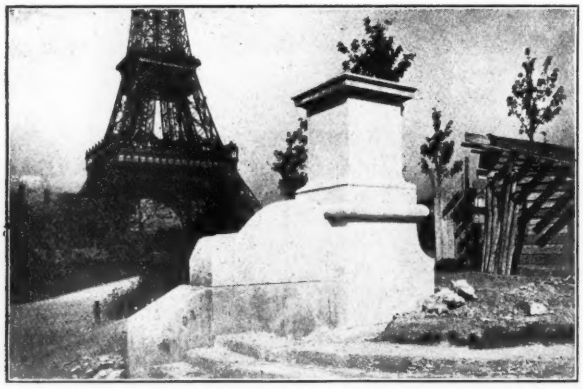
President Ely, of the Service Board of Dayton, Ohio, has instructed William J. Harris, manager of the Water-Works Department, to prepare a record of pipes in the city discovered to be affected by electrolysis, so that the city may be in a position to fight the electric railways should a legal contest be decided upon in this connection. Construction Superintendent T. J. Heffernan will have charge of the data to be prepared.



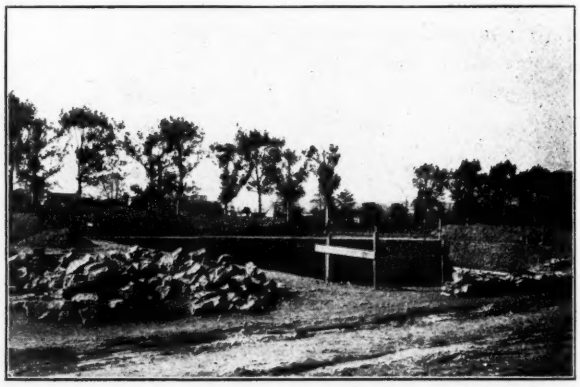
TELEGRAPHY—TELEPHONY, and WIRELESS.

The Eiffel Tower Wireless Plant.

After the French Government had come to an agreement with the municipality of Paris as regards the erection of the new high-power wireless plant at the Eiffel Tower, the War Department took measures to have the construction of the underground station and the mast-wire system carried forward as rapidly as possible, owing to the fact that the new plant is to cover a very wide range and it will thus prove of the greatest value in military operations. The present plant, which is a very small one as regards the power of the machines, is already doing considerable service in the way of wireless connection with Morocco, the scene of the present military operations.



EIFFEL TOWER PLANT—ONE OF THE STONE PILLARS FOR THE WIRELESS INSTALLATION.



EIFFEL TOWER PLANT—SITE FOR UNDERGROUND WIRELESS STATION.

Considerable headway has already been made in the construction of the plant, and the present photographs will give an idea of the work of excavating the space needed for the underground station and also of erecting the pillars for anchoring the mast wires. There are eight stone pillars of the present form, which are now almost finished. As the grounds around the tower are now being laid out as an ornamental park, it was desired to have the pillars of an attractive appearance so as to be in keeping with the rest, and as the station will be entirely underground, it will not interfere with the prospect.

The excavation for the underground plant measures about seventy by ninety feet, which gives ample room for lodging the machines and instruments. A much higher power will be used than before. The present plant was set up several years ago, in the first stages of wireless telegraphy work, and it was not equipped with machines of a large capacity, these not exceeding twenty-five or thirty horsepower.

According to the plans which were drawn up by Captain Ferrie and his aids, the new plant will have the mast wires suspended from a strong support which is built on the upper platform of the tower, and it will serve to keep the wires clear of the metallic part of the construction. This method is employed in the case of the preesnt mast wires leading to the station. There will be eight of these wires, and they will run from the supporting piece to the anchoring points on the ground. For this purpose there are used the corresponding number of stone pillars, which are about ten feet in height, and the wires coming from the tower will be solidly fixed in the top of the pillars. Cross-wires will be used to interconnect the system of eight main wires, so as to form a network, such as is used at present in the high-power stations. The tower plant will differ from the German station of Nauen, from the fact that the mast wires do not extend all around the tower in umbrella fashion, but are brought down at an angle of about forty-five degrees and lie only on one side of the tower. This was made necessary from the configuration of the ground, as the outer pillars in the present case already come near the limits of the enclosure. On the other side of the tower the ground extends for a very short distance, and the Seine is close by, so that there was no room for any additional wires in that direction. These conditions, therefore, account for the method which was used in designing the plant.

The station was placed underground for different reasons, aside from the one mentioned above of not having a structure erected in the park. The explosions of the high-power sparks would easily be heard in the adjoining buildings were the plant to be lodged at the ground level, and this would give quite an objectionable noise, especially as the station is worked during the night. Again, it would be impossible to keep the messages secret, as they could be heard in the vicinity and could be taken by anyone who was familiar with reading by sound. For these reasons it was decided that an underground plant would be by far preferable.

Seeing that there is as yet no example of a 1,000-foot mast used with high-power apparatus, it will be difficult to judge as to what distances can be reached by the tower station. To send messages across the Atlantic to New York or other coast points will, of course, be an easy matter with such a powerful plant. As to what can be done further, this is only

a matter of conjecture at the present time. Without doubt its performance will greatly exceed that of the existing wireless plants. The question of wireless telephony will also come up in this connection. It will be remembered that Lieutenants Jeance and Colin and Engineer Mercier have already succeeded in covering about 100 miles, having sent messages as far as Dieppe, on the Channel coast. These experiments are being continued with the hope of reaching the Atlantic coast and covering 300 miles. With the new station the range will be greatly increased.

New Method of Transmitting Messages.

About a year ago M. E. Mercadier described in the "Comptes Rendus" a method by which he was able to send several telegrams between Paris and Marseilles along a two-wire circuit, not connected to earth, by alternating-current signals of different frequencies, apparatus of the Hughes type being employed. It was also found that these signals could at the same time be imposed on other signals produced by continuous current, provided that with the Hughes apparatus the former lasted about 1-28th of a second, or, when the Baudot apparatus was used, that the discharges did not exceed 1-70th of a second. It was of interest from the scientific point of view and very important from the practical point of view to discover whether the same results could be obtained on a single telegraphic conductor connected to earth at its two ends, as is usually the case, or whether these phenomena were adversely affected by the natural earth currents and induced currents due to power transmission in the neighborhood of the ends of the wire. Experiments have, therefore, been made on a wire between the telegraph central stations in Paris and Lyons, using three Hughes alternating-current instruments, and also a Hughes apparatus and a four-key Baudot apparatus working with continuous current. M. Magunna succeeded in overcoming the effects of the earth currents at Lyons, where they are particularly strong, with the result that experiments turned out well, as they did in the case where two wires were employed.—*Abstracted from the Electrician (London), August 6.*

Wireless Standardization Rules.

The Wireless Institute, of New York, has appointed a committee to draw up rules for wireless-telegraph standardization similar to those of the American Institute of Electrical Engineers for other branches of the electrical industry.

Farmers' Telephones in the South.

There is something that is highly worthy of notice at this time in the field of electrical development known as the rural telephone, and this development just now is most noted in the Southern States, where a great awakening is being experienced throughout the entire country over the importance of the telephone to the farmer. Many times, for instance, cotton has jumped two, three or four dollars per bale, in a single day, and the farmer, because he lacks proper communication with the town, does not learn of this until it is too late, and the staple had fallen back to its original prices, and the farmer has lost a handsome sum of money.

The Bell Telephone Company and other companies operating in this section are waking up to the importance of the matter on all sides. To call attention to a concrete example, the Southern Bell Telephone Company, through its district manager at Charlotte, N. C., M. B. Spier, whose territory embraces the two Carolinas, is understood to be interested in the working up of "Farmers' Days" in the larger cities, at which speaking and a barbecue dinner constitute the chief attractions. The company, in a legitimate manner, has on the programme some well-informed speaker, who can tell of the advantages and needs of the telephone, while other stock-in-trade stuff is being discussed, and it is not saying too much to state that the farmer will accord an equal or more generous hearing to the man who can interest him in telephones than he will to the man whose discussion is limited to the dairy or the boll weevil, though both are important. This is only one instance of the mutual recognition by the farmer and the telephone people of the existing needs which the farmer has for the telephone service.

It has been noted in all cotton-buying centers that the average farmer is unable to reach the market with his cotton, upon hearing of a rise of fifty points to $2.50 per bale, until several days after the rise occurs, because of slow communication, whereas a telephone in such a case would pay for itself several times over, were it handy, and the farmer had an agent or friend to notify him when cotton was "kiting," for too often the price has dropped again before the farmer is able to learn of the advance and get his staple into the city and on the local market.

The farmer's interest in anything that promises to work to his advantage is always genuine, and if the telephone companies of this section once persuade the farmer that he needs the telephone, he will not be slow to adopt it. At the present time, while there may be a dozen or a score of lines running out for a distance of five to ten miles into the country from the town of 30,000 or 40,000 inhabitants, in the smaller towns the number of rural telephones is practically zero, and communication of that kind is a negligible quantity.

There is a general awakening on this subject at both ends of the line, for the city merchant is realizing that it is of just as much importance for him to be in communication with the cross-roads store or the hamlet as it is for the farmer to have the city on the other end of his telephone.

Secret Society for Telephone Men.

A secret society for independent telephone men was formed at a meeting held at Dallas, Tex., on August 7 last. Membership in the "Knights of the Shield," as the new society is designated, will be strictly limited to those connected with independent telephone companies, manufacturers, or selling agents. The following officers were elected: J. C. Casler, "Grand Inductivator"; H. D. Eberle, "Exalted Buzzer Jop"; T. A. Gould, "Supreme Condenser"; C. A. Shock, "Universal Wire Chief"; J. B. Treascott, "Transpositor"; D. C. Lingo, "Megohm"; W. H. Upham, "Ampere". The following "Trouble Shooters" were also selected: Jack Milburn, E. M. Chamberlain, H. B. Bomar, Aaron Smith, W. S. Kingsbury and J. L. Norman.

Exchanging Telephone Stock.

In accordance with an offer made by the American Telephone and Telegraph Company, about 90 per cent of the stockholders of four subsidiary companies, the New York and New Jersey Telephone Company, the Bell Telephone Company of Pennsylvania, the Central Printing and District Telegraph Company of Pittsburg and the Bell Telephone Company of Buffalo, have presented their stock in exchange for stock of the parent company. In order that stockholders who are abroad may be able to exchange their stock, the time for exchange has been extended. After the exchange of stock of the four above-named subsidiaries has been eeffcted it is expected the company will make similar offers to others of its subsidiaries.

Cedar Telegraph and Telephone Poles.

To the Editors:

There has recently been called to my attention an article which appeared in one of the monthly electrical trade papers headed "Wooden Poles and Ties," in which article the writer speaks of the enormous and steadily increasing demand for wooden poles and ties having exhausted the northeastern forests of cedar and chestnut, as also the scant supply of southern cedar or juniper, and sets forth as the only available timber left the southern yellow pine and the cypress round pole, utterly ignoring the large amount of cedar which is produced in Michigan, Wisconsin, Minnesota and in the northwest states of Idaho and Washington, as also in British Columbia.

In answer to this article the writer wishes to state that there is sufficient standing cedar in Michigan today to furnish half a million poles, twenty feet and larger, per year for the next twenty years. About half of this amount can be produced each year in Wisconsin, and in Minnesota there is sufficient standing cedar to produce a million poles per year for the next twenty years.

It seems a shame that anyone should bring forward southern timber and dare to compare it with northern or western cedar in general desirability and lasting qualities. Furthermore, in comparing costs, northern cedar today is cheaper in poles and ties than it has been at any time in the last seven years.

Southern yellow pine is undesirable, owing to its short life as ties or poles unless creosoted or treated in some way to extend its life, and even this treatment will not add materially to its length of life as compared to the same treatment of the northern or western product. A northern cedar pole or tie will outlast it three times unless the southern product is treated—we mean by northern cedar not only the Michigan, Wisconsin and Minnesota product, but the cedar that is produced in the states of Washington and Idaho, and British Columbia. The Michigan, Wisconsin and Minnesota poles in their natural state and the western product treated with creosote or some good wood preservative show a great saving over the southern product.

In view of the prices that are now being offered by the northern producer and the slight expense required covering the treatment of western product, no consumer can afford to use the southern product either treated or untreated.

In the latter part of the article it states that the cypress round pole is said to be the future round pole. Our judgment leads us to make the statement, after careful investigation, that there will still be produced Michigan and western cedar for ties and telegraph poles after what little cypress has all been exhausted.

The last of the article reads as follows: "Cypress is very porous and when used in a cold climate great care should be taken to house and seal the tops of poles thoroughly." We suppose this, being a southern timber, could not be consistently used in the North during the winter months, when it would be subject to severe colds, pneumonia, etc., and it is very certain from this article that the pole that Dr. Cook found was not of cypress or yellow pine, but possibly of cedar, which is used everywhere, in all kinds of climate, in its natural state, and does not have to be housed and sealed.

E. L. Clark,

President of the Northwestern Cedarmen's Association.

Chicago, September 9.

Wireless in China.

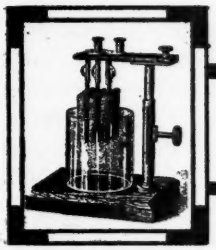
A Shanghai correspondent of a German newspaper, says the *Electrical Review*, of London, reports that a wireless telegraph installation was recently erected on the new building of the English Palace Hotel in that city, for the purpose of establishing communication with incoming and outgoing ships via Wasung. Immediately on the apparatus being brought into use, on the opening of the new hotel in July, the Chinese Government lodged a protest against it on the ground that wireless telegraphy was a state monopoly which could not be granted to private individuals. The owners of the hotel, and the British authorities on their behalf, sought to maintain the British claim, but they finally had to give way after the government expressed readiness to buy and remove the installation. The objections of the Chinese are explained, the correspondent states, by the experiments which the government recently made with systems of wireless telegraphy, and by the value which would be attached to an extension of such a network throughout that enormous empire. Owing to the great distances the existing overland telegraphs are worked at great cost, especially as they are almost exclusively carried along the river valleys and are subject to constant floods and breakages, while the wires have to be guarded in consequence of the attitude of the population.

Wireless Station at Porto Bello.

According to a recent issue of the *Canal Record*, Ancon, Canal Zone, the wireless station at Porto Bello is to be installed solely for the benefit of the Isthmian Canal Commission, for communication with the Colon station, but to be under the control of, and to be equipped and manned by, the Bureau of Equipment, Navy Department. With this understanding the commission has built a house containing the office and condenser room, besides living quarters for three operators, enlisted men of the navy. This house is from a special design drawn in the chief engineer's office, and is situated on the hillside just below the eastern end of the reservoir dam. The mast will be erected on the hill east of the reservoir at a sufficient distance for the aerial wires to reach from its upper end to the office. The "ground" will be obtained by large copper plates sunk in the shore of the reservoir. The house is about finished, and the aerial and guys for the mast have been received, but until the mast, instruments and ground plates are sent by the Navy Department no further progress can be made. These are expected soon. The mast will be about 150 feet high, set on a hill 135 feet above sea level, making the extreme height 285 feet, sufficient for the waves to clear the intervening hills. The power will be carried to the station from the commission's power plant at Porto Bello.

Why Wireless Communication Is Easier Over Water than Over Land.

It is well known, says the *Scientific American*, that Hertzian waves can be transmitted more readily over water than over land. The reason for this was explained quite recently by Prof. J. A. Fleming in a popular lecture. He showed that a current of high frequency could be transmitted over a galvanized-iron wire as readily as by means of a copper wire, but that if the zinc was burned off the wire, so that the current had to traverse an iron path, there was a considerable reluctance. This showed that high-frequency currents, which normally travel over the surface skin of a wire, will penetrate farther into the metal of low conductivity. The Hertzian waves do not penetrate water to a depth of more than a few feet, but when traveling over dry soil there is a much greater penetration, due to the poorer conductivity, which results in a correspondingly greater loss of energy.



ELECTRO-CHEMISTRY and METALLURGY

Electrochemical Amalgamation.

In a letter to the editor of the *Scientific American,* Elmer Ellsworth Carey, of San Jose, Cal., gives some interesting facts and observations of the subject of electrochemical amalgamation. An abstract of Mr. Carey's letter is given below:

In recent years it has been discovered that there are large areas in southern California, Nevada, Arizona, New and Old Mexico, which contain vast deposits of low-grain sands containing gold values averaging from $1.50 to $7.50 per ton. Many of these deposits are of unknown depth. The values are microscopic, and there is no method at present known to the miner by which the values can be profitably extracted. There are also immense ledges and even mountains of low-grade ore, very refractory, which cannot now be profitably mined. The sea beaches from the Isthmus to the Arctic contain vast deposits of gold-bearing sands, but no practical method is known of recovering the gold, which is fine and flaky, and which cannot be saved by the usual gravity devices. In addition to these unworked gold fields, there are in California many miles of river beds containing debris and tailings from the placer mines; these tailings contain gold to the amount of $1 per ton, this amount being a low average, and the tonnage is beyond computation. The values are too elusive for extraction by any of the standard processes of gold saving.

In Alaska there are hundreds of miles of beach and river deposits containing vast sums of gold which are beyond the reach of the miner.

Scores of gold-saving machines working on the gravity principle have been constructed in a vain endeavor to solve the problem; amalgamating devices have been tried, but the impalpable values will not adhere to the amalgam surface; and when the particles of gold are larger, it is found often that the gold is coated or rusty or oily, so that mercury has no affinity for it.

About twenty years ago tests were made with a device using electrochemical principles and the results were very encouraging. The science of electrochemistry has made wonderful strides in the last decade, and lately the problem of saving the impalpable values mentioned above has been approached in a practical manner by various experimenters.

It has been found that the amalgamating action of mercury is greatly increased in the presence of electrochemical conditions, and devices have been constructed to utilize this fact in a commercial way. The bottom of a sluice box is covered with a copper sheet or plate; suitable electrodes (anodes) are arranged so that they may come in contact with the surface of the water flowing through the device; a solution containing a definite amount of mercuric bichloride is added to the water, and a low-voltage generator is connected with the anodes and the copper plate (cathode). The mercury from the solution is deposited in its nascent form on the copper plate, forming an amalgamating surface of the highest efficiency. The electric current passing through the water (electrolyte) cleans and brightens the gold, and all unfavorable conditions are practically destroyed.

The microscopic gold particles are coated with mercury while in suspension, and the cataphoretic action of the electric current, aided by gravity, forces the values into an amalgamating contact with the mercurial surface. All values are deposited in the form of amalgam, which adheres tenaciously to the plate by the electroplating action of the electric current. Thus there is an electrolytic amalgam which is smooth, firm, tenacious, yet elastic and viscid. The amalgam is not dislodged; and the mercury does not "flour." All the electrochemical processes assist in cleaning the gold, forcing it to the plate and holding the resulting amalgam in place.

A current with a voltage too low to produce a shock is sufficient to give results that are marvelous; the device is so simple that its potency would never be suspected; its cost is trifling, and any electrician can make the installation. Yet the percentage of extraction is so high that ordinarily the tailings contain no values of importance.

Production of Abrasives in 1908.

The total value of the natural abrasive materials produced in the United States in 1908, according to a report by W. C. Phalen, of the United States Geological Survey, was $1,074,039, a decline of $606,698 from the figure for 1907. The value of the artificial abrasives produced in 1908 was $626,340, a decline of $400,906 from the 1907 value. The value of the imports amounted to $476,073, a decrease of $278,067. The total value of the abrasive materials consumed in this country during the year was therefore $2,176,452.

The natural abrasives include oilstones and scythestones, grindstones and pulpstones, buhrstones and millstones, pumice, infusorial earth and tripoli, abrasive quartz and feldspar, garnet, corundum and emery. These were produced in twenty-three states. The artificial abrasives, made in the electric furnace, comprise alundum and carborundum (which are manufactured only at Niagara Falls, N. Y.), and crushed steel. Mr. Phalen's report contains details of the domestic production and imports of these different materials, and notes on the methods of preparing them for the market. It is published as an advance chapter from "Mineral Resources of the United States Calendar Year 1908," and a copy may be had free on application to the director of the Survey, at Washington.

Electrolytic Copper Staybolts and Pipes Claimed Unreliable.

According to statements in recent German trade papers, staybolts of electrolytic copper have given bad results in locomotives on Prussian railroads, and a large number of fractures have resulted. Only one out of twenty-one samples tested of these defective bolts showed arsenic, and it is to be presumed that the lack of "nature" of electrolytic copper may be due to this deficiency. Steam pipes of electrolytic copper are growing into disfavor in England, as they have repeatedly proved unreliable. A reference to this was made in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, April 24, 1909, p. 748.

The Validity of Ohm's Law for Electrolytes.

It is often assumed tacitly, and, indeed, stated also in textbooks, that Ohm's law will hold for electrolytes. That this is not strictly correct was pointed out many years ago by Kohlrausch. It is only immediately after closing the circuit of an electrolytic cell, before any concentration differences have been established, that Ohm's law can be applied; for Ohm's law presupposes the non-existence of a concentration gradient. During this non-stationary period of short duration relations prevail which, Kohlrausch demonstrated, resemble those required by Ohm's law. But conditions change soon owing to the migration of the ions, and during the ordinary stationary period of the electrolysis Ohm's law is not valid. Calculations have then to be based upon Nernst's equations, and though these equations lead to relations similar to those expressed by Ohm's law, they are by no means identical with them. The terms "stationary" and "non-stationary" periods are used by A. Eucken, of Berlin, in a mathematical paper on the problem published in the *Physikalische Zeitschrift*. In a certain measure the conduction of the current through electrolytes resembles that of conduction by gas ions, which obey Ohm's law for currents of low intensity. The deviations from Ohm's law are, however, not very great in the case of electrolytes, because the stationary period is very difficult to realize, owing to convection currents, at least for the main portion of the electrolytic cell, or trough. Near the electrodes the conditions are fairly stationary, but not further away from them. Yet it should be possible, as Grassi showed in 1903, with certain precautions, to produce an almost stationary concentration gradient throughout the trough, and by experimenting in this direction Eucken's formulas might be tested.—*Abstracted from Engineering (London), September 3.*

A Unique Hydroelectric Plant.

A hydroelectric plant which operates with a twenty-four-hour service without attendance and without a storage-battery auxiliary, has recently been installed at Blair Castle, the Scotch seat of the Duke of Athol. The three dynamos are direct-coupled each to a sixty-horsepower Pelton wheel, and the current generated, besides lighting the duke's house, will also be utilized to light a number of the villages in the vicinity.

To Discover Radium in the United States.

A movement is on foot in this country to place the United States, if possible, to the front as a producer of that rarest and costliest of all elements, radium. Thomas F. Walsh, of Colorado, is taking the initiative in this, through the Vinson-Walsh research department of the Colorado State School of Mines at Golden. This department, which is supported financially by Mr. Walsh, will make free tests of all samples of pitchblende submitted by prospectors and others, and the results will be regarded, if desired, as confidential; this with a view to encouraging prospectors, mine operators, and all others interested in the proposition, to look for this mineral and so found a new mining industry of much profit in this country. Victor C. Alderson, president of the Colorado State School of Mines, has stated that the school will, to a limited extent, be prepared to furnish samples of pitchblende to responsible parties who would be likely to aid in the search and who desire to familiarize themselves with the appearance of the mineral.

Electricity in South African Mining.

The plant at the South African Simmer Deep and Jupiter mines has the distinctive feature of being entirely driven by electricity, from the stamps right down to the last pumps in the extractor house. The 300 stamps are driven in lots of ten by separate three-phase motors of about fifty horsepower each. The pulp, after passing over the amalgam tables, is pumped to twelve classifiers, and the underflow from these goes to four tube mills driven by separate 125-horsepower motors. Twelve conical sand separators are used and the time occupied by the circuit of the sand from the mill to the dumps is only about six-and-one-half days, the usual time for sand treatment being nearly ten days.

A Good Sign.

News dispatches from Pennsylvania state that more than 100 men responded last Monday morning to the call when the whistle at the McCall Ferry power plant, at Lancaster, Pa., gave its signal for beginning work. Two years ago operations ceased on the great dam, and the men who went back to work were employed at the concrete building. The plant is eighty per cent finished, and it is estimated that the power can be turned on in a year.

How to Make a Simple Dry Battery.

In a recent number of the *Scientific American*, George F. Worts gives instructions for making a simple dry battery which will be available for many purposes where the ordinary standard shop cells may not be so adaptable.

To make a cell of the standard size, a strip of zinc of medium thickness, eight-and-one-fourth inches long and six inches wide, is necessary. The zinc is rolled into a cylinder six inches long and eight inches in circumference, thus leaving a quarter of an inch which is to be tightly soldered. A zinc cap is next soldered on one end of the cylinder. Any solder showing on the inside is to be well shellaced. Do not shellac any zinc surface, as that will interfere with the action of the battery. Line the inside of the cylinder with a thin layer of blotting paper. For the positive pole of the battery the carbon from a worn-out cell is the best, if procurable, but if not, a bundle of arc-light carbons with the copper surface well filed off is the next best. The chemicals for producing the action that generates the electricity are one-fourth pound of sal ammoniac, one-fourth pound of chloride of zinc (paste form), one-fourth pound oxide of zinc and one-fourth pound plaster of Paris. These should be thoroughly mixed with a mortar, and packed tightly in the cylinder about the carbon, which is a half inch from the bottom of the cell. This paste will fill the cylinder to within half an inch of the top, the rest being filled with paraffin. A copper terminal soldered to the zinc and a heavy copper wire scraped clean and bound about the protruding end of the carbon, form the negative and positive connections for the cell.

This cell can be easily formed in various other shapes to suit the experimenter's fancy. The cell herein described, if constructed according to specifications, will produce very satisfactory results, especially in ignition work or for wireless. It will register about 1.4 volts and between ten and fifteen amperes.

Electric Drive in Brazilian Mills.

A dispatch from Rio de Janeiro states that the local tramway, light and power company is now furnishing electric power to the following cotton mills: Cia Americana (1,350 horsepower); Fabrica Carica (800 horsepower). The latter mill will ultimately use double its present electric power when satisfactory arrangements can be made to do so.

Joint Convention of the Northwest Electric Light and Power Association and the Seattle Section of the American Institute of Electric Engineers.

A very successful joint convention of the Northwest Electric Light and Power Association and the Seattle Section of the American Institute of Electrical Engineers was held on the grounds of the Alaska-Yukon-Pacific Exposition, Seattle, Wash., on the 7th, 8th and 9th of this month.

The Northwest Electric Light and Power Association was organized about a year ago, embracing the states of Washington, Oregon, Idaho and Montana, and the territory of Alaska. It is already an influential and live society, and includes in its membership more than ninety per cent of the operating companies in the territory embraced. Its object is "to foster and protect the interests of those engaged in the commercial production of electricity for conversion into light, heat and power, and of their customer's," and its constitution is modeled after that of the National Electric Light Association. The Seattle Section of the American Institute of Electrical Engineers has over a hundred active members throughout the state of Washington, the greater number of whom reside in Seattle, Spokane and Tacoma.

The headquarters of this convention were established in Machinery Hall on the Alaska-Yukon-Pacific Exposition grounds, where the secretaries of the two societies had desks and conducted a bureau of information for the benefit of members and guests. The office had an attractive display of photographic views of interesting engineering features in the different plants represented.

The meetings were held alternately in the lecture rooms of the Fine Arts Palace and the Good Roads Building on the exposition grounds, and in spite of the many other attractions on the grounds were well attended. The opening session was held in the auditorium of the Fine Arts Palace, at 10 o'clock Tuesday morning, with Arthur Gunn, president of the Northwest Electric Light and Power Association in the chair. The address of welcome was delivered by Mayor John F. Miller, of Seattle, and was responded to by O. B. Colwell for the Northwest Association and by Ralph W. Pope, national secretary of the American Institute of Electrical Engineers.

After these preliminary exercises followed the first technical session of the American Institute of Electrical Engineers, with John Harrisburger, president of the Seattle Section, in the chair. Ralph W. Pope, national secretary, made the first address on "Administration of Institute Affairs." He gave the members a glimpse of the inside workings of the Institute and paid the West some flattering compliments on its progress and achievements.

C. E. Fleager, of the Pacific Telephone and Telegraph Company, followed with a paper on "The Modern Central Telephone Station," and Paul M. Lincoln, of the Westinghouse Electric and Manufacturing Company, with a paper on "Protection of Electrical Equipment." Mr. Lincoln elaborated on the water analogy of electrical surges on transmission lines, and showed without the use of mathematics what occurs on line and in apparatus during lightning discharges.

In the afternoon W. M. Hamilton, of the Portland Railway, Light and Power Company, read an interesting paper on "Electrical Illumination from the Central-Station Basis," especially emphasizing the importance of every lighting company employing a man who could devote at least part of his time to studying and solving the many difficult illumination problems that come up, in accordance with more modern scientific practice. He showed how this would greatly lighten the burdens of the complaint department.

E. W. Sherwood read a paper on "High-Efficiency Lamps" and Chas. F. Scott, past president of the American Institute of Electrical Engineers, read a paper on "The Trend of Electrical Development," showing what electricity had done in the past, and hinting at what might reasonably be expected of the future.

On Wednesday forenoon was held the first commercial session of the Northwest Association, and this was taken up with reports of the committee on rates and the committee on uniform accounting, as well as with papers of commercial interest. Among the topics treated may be mentioned "Methods of Handling Complaints," "Electric Appliances and Their Influence on Load Factor," "The Electric Vehicle as a Correction of Poor Load Factor."

On Wednesday afternoon was held the first executive session which was given over to the president's address, reports of the treasurer, the auditing committee, and the legislative committee, and a general discussion of what the association had done and what it had failed to do.

On Thursday morning was held a second executive session at which, among other papers, was an able discussion by J. E. Frost, chairman of the State Board of Tax Commissioners, of the need for uniformity as well as publicity of accounting by public service corporations. Mr. Gunn, president of the Wenatchee Electric Company, read a paper on "Employers' Liability and Employees' Indemnity," outlining means of avoiding present expensive and unsatisfactory legal methods of settling damage suits. He advocated some system of compulsory insurance against accidents as a matter of economy and as affording the quickest and most satisfactory relief both to the injured and those dependent on them.

The entertainment committee deserves especial praise for the excellent entertainment programme provided for the members and guests of the societies during the entire convention period. On Tuesday evening the reception committee and officers of the association held a reception to members and guests in the Washington State Building, followed by dancing. Punch, ice cream and cake were generously served during the evening. Wednesday and Thursday forenoons were given over to trolley rides about the city for the ladies and guests, while Wednesday afternoon was devoted to a boat trip around Lake Washington, and Thursday afternoon to a trip on the Sound around Bainbridge Island to the United States Navy Yard at Bremerton and other points of interest. Thursday evening capped the climax of good things, as well as concluded the convention, with a vaudeville performance and entertainment at the Cafe Chantant, Luna Park. Mr. Ross, of the Seattle city light plant, delighted the audience with his famous high-tension experiments.

Another New Society.

A movement, sponsored by J. C. Jurgensen, head of the new department of "Plant Management" at Columbia University, New York city, is under way toward the formation of a proposed "Society of Operating Engineers." Members will consist of those directly interested in power-plant operation, and associate members will comprise the owners of such plants. Special attention will be paid to the instruction of apprentices, which will include a scheme of co-operation with such evening courses as that at Columbia University under the direction of Mr. Jurgensen. The new movement is one in the right direction, and it is to be hoped that the efforts of the promoters will receive the attention and consideration they deserve.

The Peat Industry in 1908.

A report on the production of peat in 1908, by C. A. Davis, has just been published by the United States Geological Survey as an advance chapter from "Mineral Resources of the United States, Calendar Year 1908." The total supply of peat in the country, exclusive of Alaska, is estimated at twelve billion tons of air-dry fuel. The peat beds of commercial importance lie almost entirely outside of the territory in which coal and other natural fuels are abundant. Mr. Davis's report contains not only the statistics of production, but a description of the methods of preparation and the uses of this substance.

The most important use of peat is for fuel. It is particularly suited for use as domestic fuel, as, when properly prepared and managed, it makes a hot and durable fire. Its theoretical heating value is about five-eighths of that of the best bituminous coal, but owing to the small waste in ash, etc., its real value is doubtless nearly if not quite as great as that of some coals that are used for domestic purposes.

The most recent fuel use of peat is as a source of producer gas. The gas producer shows so great a fuel economy that it can profitably utilize grades of fuel that could not be used for steam generation, and in Europe peat is finding a growing use for this purpose. Well-prepared peat gives from 40,000 to 80,000 cubic feet of producer gas per ton of dry matter, with a calorific value no less than that of gas made from coal. Some progress has been made in the recovery of valuable by-products in the generation of gas from peat.

Peat is of value for numerous other uses, such as bedding for stock, packing material, deodorizing material, and fertilizer filler. Dry peat powder is used to absorb the refuse molasses of sugar factories, the mixture being sold as stock food. A peat-moss litter and mull plant is operated at Garrett, Ind., and factories for making peat fertilizer filler have been established in New Jersey, Pennsylvania, New York, Ohio, Indiana, Illinois, and Florida; some of these have not been carried beyond the experimental stage. Fibrous peat has been mixed with certain mineral and cementing substances and then subjected to hydraulic pressure, the resulting material being tough and hard and capable of use as a structural material or for paving blocks. This industry is inconsiderable as yet.

The production of peat fertilizer filler in 1908 was 23,000 tons, valued at about $121,000. The peat fuel made during the year was all machine peat, the total output being 900 tons and the selling price from $5 to $7.50 a ton. Peat-moss litter is sold in bales of 225 pounds; the production for 1908 was 8,000 bales, valued at $10,000. The imports of peat during the year consisted of 8,102 tons of fuel moss, valued at $45,414, and a few tons of peat fiber.—*Abstracted from the United States Geological Survey Press Bulletin, September, 1909.*

Electrical Development in Mexican Mines.

According to a recent issue of the *Mining and Scientific Press,* San Francisco, Cal., the Buena Fé Mining Company, operating near Ojuelos, Mexico, is erecting a large plant, including a gas producer using charcoal, a Westinghouse three-cylinder gas engine, which will be used to drive an electric generator and an air compressor. Electrically driven station and sinking pumps will be used in the mines. The G. & O. Braniff Company supplied the plant. The Mexican Coal and Coke Company, which is operating mines at Esperanzas, has recently placed orders for a considerable amount of extra machinery, including an 1,100-horsepower Schoendube and Nengebaur steam turbine and condenser, which will be used to drive an alternating-current generator; also a number of transformers, motors and accessory electrical apparatus The same company has also ordered sixteen Sulzer pumps, the largest being a 350-horsepower multiple-stage centrifugal pump.

New Process for Extracting Radium.

There seems a probability, according to the London *Mining Journal,* that the extraction of radium is to be taken up energetically at the Trenwith mine, Cornwall, Eng. Sir William Ramsey, the chief consulting chemist to the British Radium Corporation (Ltd.), has produced radium from the ore of this mine by his new and secret process. His researches have already passed the laboratory stage, and he has been enabled to produce this article on a commercial scale. Sir William Ramsey's new process for the extraction of radium is cheaper, quicker and more effective than any hitherto known. The radium produced will be disposed of upon highly remunerative terms.

Pole Preservative Experiments.

The unpleasant discovery that telegraph poles impregnated with copper sulphate by the Boucherie process are so readily attacked by fungi that in some districts they last only eight or ten years, has led the Austrian government telegraph bureau to institute experiments in the preservative action of fluorides. In the preliminary experiments air-dried poles were saturated with solutions of acid zinc fluoride containing a little free hydrofluoric acid. After two years' service from eighty to 100 per cent of these poles showed a surface absolutely intact, while of the poles treated with copper sulphate, after two years' service, only fifty per cent remained free from fungi and ten per cent were badly rotted. In subsequent experiments on a larger scale the poles were impregnated with acid zinc fluoride, both by steeping and by hydrostatic pressure. Analysis of the water which drained from the poles showed that all of the free acid and a large part of the loosely combined acid had been absorbed by the wood.—*Abstracted from Telephone Engineer (Chicago), for September.*

August Meter Tests.

The New York Public Service Commission has issued a report on the testing of gas and electric meters for August. During that month 30,192 gas meters were tested, of which 4,476 were new, 25,539 repaired and 177 complaint meters. Of these complaint meters it was found that 36.7 were two per cent or more fast. 11.1 were two per cent or more slow, and 51.4 between two per cent slow and two per cent fast.

For the same month forty electric meters were tested, and of these it was found that ten per cent were four per cent or more fast, five per cent were four per cent or more slow, and eighty-five per cent between four per cent slow and four per cent fast.

Outing of the Philadelphia Electric Company at New York.

A steamboat trip around Manhattan, three automobile rides through different parts of the city, an exciting game of baseball at the American League Grounds and a dinner at Pabst's Harlem Casino was the programme followed by the New York Edison Company in entertaining the employes of the Philadelphia Electric Company at New York, Saturday, September 11.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing, is always interesting. "Actualities," the actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE MOLONEY ELECTRIC COMpany, St. Louis, Mo., has received the following important contracts during the last thirty days:

Three 500-kilowatt water-cooled transformers for the Walla Walla Electric Light and Power Company, Walla Walla, Ore.

Eighty transformers for the lighting department, city of Tacoma, Wash. These transformers range in size from five to forty kilowatts.

One hundred and forty-two transformers, lighting department, city of Pasadena, Cal. These transformers range from three to forty kilowatts.

Seventy-three subway transformers, ranging in size from one to fifteen kilowatts. This order was secured from the Schott Engineering Company, Chicago, and the transformers are to be installed at the United States Naval Training Station, North Chicago, Ill.

THE ALABAMA AUTO AND ELECTRIC COMPANY, Montgomery, Ala., advises that the West Auto and Electric Manufacturing Company has recently taken in more stockholders and reincorporated under the name of the Alabama Auto and Electric Company, and under the new management has discontinued the contracting business and become jobbers of electric supplies as well as automobile sundries, having in this connection a repair shop and automobile garage.

WILLIAM G. REUTER, electrical contractor, Cincinnati, Ohio, has received the contract for the electrical equipment for the Ohio Mechanics' Institute, the building being a gift of a half-million dollars to erect this Institute, from Mrs. Mary Emery, and the theatre therein contained to be called Emery Hall. The amount of the electric contract was $14,000. He has also just completed electric work for the new Hughes High School, which opened for school on September 7.

THE MILLS ELECTRIC COMPANY, Peoria, Ill., advises that it considers the building situation in this vicinity as encouraging, a number of excellent structures being in the course of erection in Peoria. The electrical contractors of this city are busy.

An ordinance recently passed compels all wire men and shop owners to pass an examination and a fee is charged for an annual license. Another provision of the ordinance compels the use of rigid iron conduits in all buildings within the fire district and in other buildings which may be used as stores or occupied by more than two families. Both of the provisions in the above-mentioned ordinance are going to materially benefit the electrical trade. This company is now engaged exclusively in the jobbing business, and looks forward to a very busy fall and believes that conditions generally are improving rapidly in this locality.

THE DES MOINES ELECTRIC CONTRACTING COMPANY, Des Moines, Iowa, was recently awarded the contract for wiring the Des Moines Coliseum and also the White Line warehouse, an eight-story fireproof building.

They were awarded the contract by the Federal Electric Company, of Chicago, to erect one of its electric signs in this city, one for the Hotel Wellington and the other for the Des Moines Brewery. These signs are fifty feet long and twenty feet high.

The company also received the contract for wiring two new public school buildings in this city.

THE RICHARDSON ELECTRIC COMPANY, Duluth, Minn., has just finished the installation of 225 horsepower, in General Electric, three-phase, 440-volt, twenty-five-cycle motors, ranging from nine to seventy-five horsepower in capacity, together with complete installation and equipment required for the substation, consisting of Westinghouse electrolytic lightning arresters, disconnecting switches, series and potential transformers, type "B" oil switches—all for the control of the machinery just being started in the Stott Briquetting Plant, at Superior, Wis. The entire lighting contract for power and lights was executed by this company.

The Stott Briquetting Company takes coal dust from the various large coal docks at the head of the lakes and compresses it into small egg-shaped lumps called "briquets," using a certain amount of pitch or binding materials, and the material can be sold in the open market at very much less than the regular prices on equal qualities of hard coal, and is most excellent material for household or for power house fuel.

THE JAS. B. CLARK, JR., ELECTRIC COMPANY, Louisville, Ky., has just been awarded the contract for one 400-kilowatt, three-phase, sixty-cycle, engine-type alternator, for the new plant of B. F. Avery & Sons, and six fifteen-horsepower elevator motors, sold to the American Machine Company, of this city, for use in connection with their elevators, which it has contracted to furnish the B. F. Avery & Sons firm. Also one 100-kilowatt engine type alternator and twenty-five motors to the Never Split Seat Company, at Evansville, Ind. One 100-kilowatt, engine-type direct-current generator and fifteen motors to the Ingalls Stone Company, Bedford, Ind.

All of the above apparatus is of the Willey type, its own manufacture.

THE AMERICAN ENGINEERING COMPANY, Indianapolis, Ind., has a contract for the engineering and construction of the Des Moines & Sioux City Railroad in Iowa. The survey of this line has been completed, and it will be something over 200 miles in length. It has advices from the owners of the road that construction work on the same will probably begin some time this fall.

THE ELECTRIC CONSTRUCTION COMPANY, Little Rock, Ark., announces that, owing to increase in its business, it will move into larger quarters at 215 Louisiana Street, in the Gazette Building, October 1, this move being made necessary by the addition of a plating and chandelier factory and a steady increase in the business.

It will commence shortly on the wiring of the new ten-story annex to the Marion Hotel of this city. This will be a fireproof reinforced concrete structure, and is one of the largest contracts ever awarded in this city.

Business appears very bright in this locality and every one is busy.

The company is just completing the Carnegie Library, donated to the city by Andrew Carnegie.

THE PIEDMONT ELECTRIC COMPANY, Asheville, N. C., has just closed a contract with the Unity Cotton Mills, La Grange, Ga., for the installation of 750 lights and wiring for power circuits.

It has also just secured the contract for installing in the Manchester Cotton Mills, Manchester, Ga., wiring and lamps for 650 tungsten lamps, also wiring for power circuits.

The company is engaged at the present time in installing wiring system in the million-dollar post office and court house

being built at Atlanta, Ga., and lighting systems in court houses at Fitzgerald, Ga., and Mocksville, N. C., as well as other smaller contracts in the Carolinas.

Copper Production for August.

August made another new high record in copper production, the output having amounted to 115,101,440 pounds, compared with 113,281,820 pounds in July and 99,048,000 pounds in August a year ago. This compares with a refinery output of refined copper for August of 120,000,000 pounds, which was likewise record-breaking, a figure which would indicate the treatment of foreign ores returning about 10,000,000 pounds of copper.

Mine production figures for August with seven previous months for three years compare as follows:

	1909.	1908.	1907.
January	102,100,509	65,900,000	84,935,143
February	96,304,000	65,036,750	85,288,160
March	107,961,369	79,105,704	98,438,230
April	104,755,000	87,582,805	96,567,700
May	110,163,000	90,880,300	98,500,000
June	111,092,000	79,431,725	96,123,030
July	113,281,820	92,109,000	98,623,870
August	115,101,440	99,048,700	93,298,107
Total	851,759,138	659,094,984	751,774,240

Albany & Hudson Sold.

Referee John P. Kelly, of Troy, N. Y., sold the properties of the Albany & Hudson Railroad at Public auction in Hudson. The purchaser was I. W. Day, of New York, the secretary of the reorganization committee, and the price paid was $550,000. Day was the only bidder.

The special committee on reorganization, Secretary Day, Myron T. Herrick, R. A. C. Smith and Clinton I. Rossiter, will at once perfect the plans of reorganization. After the formal incorporation the company will take steps toward double-tracking the road, the acquirement of the Greenbush bridge, the improvement of the power houses, and the completion of the line to Pittsfield.

The sale was made on an order of court pursuant to a judgment of foreclosure and sale in the action of the Trust Company of America.

A Lubricating Hint.

An experienced motorist, says *Automobile Topics,* suggests the introduction of graphite into lubricating oil, in the proportion of about a teaspoonful to a pint of oil, claiming that it builds up even the most microscopic irregularities on bearing and wearing surfaces of pistons, rings and cylinders, resulting in better lubrication in cylinders, better compression and a saving of oil. He recommends flake graphite.

Low Temperature in Magnetism.

In a recent paper by G. Gray and H. Higgins, presented before the Royal Society of Edinburgh, the authors describe some striking experiments on low-temperature effects in magnetism. The experiments were a continuation of the researches of Dewar and Fleming, which were described in Vol. 60 of the Proceedings of the Royal Society.

The present experiments were performed on steel wire, special hard steel, and manganese steel, starting with a specimen magnetized to saturation at the temperature of liquid air. In the case of the steel wire, magnetized at a temperature of minus 190 degrees centigrade, the effect of warming it to the room temperature decreased the magnetic moment about forty-four per cent, whereupon a cooling to the initial low temperature increased the magnetic moment about 12.5 per cent. When the specimen was annealed and the above procedure repeated, the effect of warming the cooled specimen to room temperature caused a diminution of sixty-five per cent in the magnetic moment, after which each cooling resulted in an increase of nearly forty per cent in the magnetic moment. With the specimen in a quenched condition and magnetized at a temperature of minus 190 degrees centigrade, warming decreased the magnetic moment by sixteen per cent, and with the specimen in this condition the magnetic moment at the low temperature exceeded by about 1.5 per cent the magnetic moment of the piece when it was magnetized to saturation at room temperature.

Some remarkable results were obtained with manganese steel in the annealed condition. When a specimen was magnetized at room temperature the magnetic moment was found to be 250 centimetre-gramme-second units. Cooled to the temperature of liquid air this decreased to ninety-three units, and on allowing it to attain to the temperature of the room it fell further to fifty-nine units. From and after this time, cooling the specimen to a temperature of minus 190 degrees centigrade increased the magnetic moment about nine per cent. When the specimen was magnetized at the low temperature the magnetic moment was found to be 590 centimetre-gramme-second units. Warming to room temperature caused this to become reduced to 387 units, and further cooling to the low temperature increased the magnetic moment about thirteen per cent.

The above were only a portion of the experiments, but enough to indicate the general effects. The results differ from those of Dewar and Fleming in that the reversible condition is arrived at after the first warming up from the low temperature to that of the room, and the percentage change in magnetic moment caused by cooling from the temperature of the room to that of liquid air is much greater than when the specimen is magnetized initially at room temperature.

Exports of Manufactures, 1789-1909.

Twelve billion dollars' worth of manufactures have been exported from the United States in the last 120 years, eight billions, or two-thirds, of this enormous total within the last twenty years, and six billions, or one-half, in the last eleven years. This is the summarization of a statement just prepared by the Bureau of Statistics, of the United States Department of Commerce and Labor, Washington, D. C.

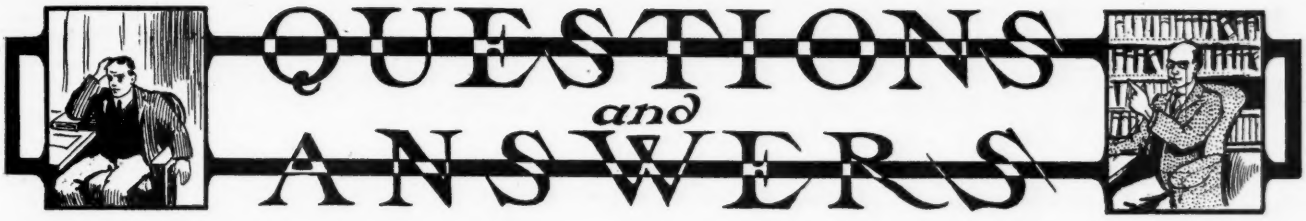
The bureau finds that the total exports of domestic merchandise of all kinds during the 120 years have aggregated forty-six billion dollars, of which twelve billions, or twenty-six per cent, were manufactures. The value of the manufactures exported since 1898 is as great as all that exported in the 109 years prior to that date, while the total for the last twenty years is twice as great as the total of the immediately preceding 100 years.

The share which manufactures form of our exports has steadily advanced as the years have passed. This is shown in the following table, giving the total value of domestic exports, exports of domestic manufactures, and percentage which manufactures formed of total exports, by ten-year periods, 1790-1909.

Ten-Year Period.	Total Domestic Exports.	Manufactures Exported.	Per Cent Which Manufactures Formed of Total.
1790-1799	$ 293,642,204	$ 18,855,859	6.42
1800-1809	371,253,875	29,208,139	7.87
1810-1819	453,384,324	31,266,810	6.90
1820-1829	525,371,141	57,521,133	10.95
1830-1839	828,542,275	78,059,253	9.42
1840-1849	1,096,649,373	114,556,288	10.45
1850-1859	2,140,144,928	353,991,773	16.54
1860-1869	2,329,095,758	479,357,780	20.58
1870-1879	5,301,556,001	1,078,638,471	20.35
1880-1889	7,480,115,627	1,500,552,772	20.06
1890-1899	9,536,355,659	2,411,408,166	25.29
1900-1909	15,550,676,564	5,855,613,378	37.66
Total	$45,906,787,729	$12,009,029,822	26.16

Copper Exports.

Exports of copper for the week ended September 9 were 2,608 tons. Since September 1 they were 4,067 tons, compared with 3,916 tons for the same period of last year.



INDUCTION-MOTOR SPEED.—How is it possible to change the speed of an induction motor?—M. S., Tampa, Fla.

The induction motor is primarily a constant-speed machine; however, a number of ways of making this type of motor run at various speeds have been perfected, and of these methods some are quite satisfactory. The induction motor that is referred to in this answer is the ordinary single-phase or polyphase induction motor, but not the single-phase series induction motor. The methods for changing the motor speed are as follows: (A) By changing the number of poles of the motor the speed can be changed in the ratio of two or even three to one. These speeds, however, are fixed, and no intermediate speeds can be provided for by this plan. In carrying out this method taps are brought from the primary winding and connected to a double-throw switch, which is arranged to change the number of poles to one-half of the original number, thus giving two speeds. In some cases three speeds can be provided where three different numbers of poles are permissible. (B) A method that gives a more variable speed adjustment is by the insertion of resistance in the primary circuit of the motor, which in effect cuts down the electromotive-force applied and, therefore, reduces the speed. This method, however, is not very desirable, because it does not give a stable speed for heavy load at low speed. Moreover, the external resistance consumes considerable energy. (C) An improvement over the last method is to use an auto-transformer in place of the resistance. This enables the attainment of a variable primary voltage without appreciable loss. An ordinary transformer with a number of taps on its secondary could be used instead of an auto-transformer. (D) A still more common method than either of these is the insertion of resistance in the rotor circuit. For this method, wound rotors with slip rings are used, the resistance being connected externally to the brushes bearing on the rings. If this external resistance is variable to a considerable extent, a large variation of speed can be attained.

EFFICIENCY OF MERCURY-ARC RECTIFIER.—What is the efficiency of a mercury-arc rectifier for changing alternating into direct current? Does such a rectifier produce a pure direct current?—W. M. P., St. Louis, Mo.

The efficiency of a mercury-arc rectifier depends somewhat upon the operating conditions, particularly upon the voltage of the direct-current circuit fed from the device. From fifteen to twenty-five volts are usually lost in the tube. This represents the energy converted into light and heat. This loss is almost independent of the load. If the rectifier is delivering direct current at a low voltage—say, about twenty-five volts—its efficiency will be only about fifty per cent. If it is developing about eighty volts direct current from the 110-volt alternating current, its efficiency will be probably over eighty per cent. Rectifiers operating on constant-current circuits are said to have an efficiency in excess of ninety per cent at full load. The direct current rectified by means of the mercury-arc device is not a pure direct current of absolutely constant value, but it is a slightly pulsating current, which, for practical purposes, may be considered to be substantially a direct current in the ordinary use of the term, since the wave peaks corresponding to the frequency of the alternating-current circuit are comparatively small.

DIRECT-CURRENT AND ALTERNATING-CURRENT VOLTMETERS.—I understand that an alternating-current voltmeter can be used on direct-current circuits, but that no direct-current voltmeters can be used on alternating-current circuits. Why is this so?—J. O. Z., Fresno, Cal.

Alternating-current voltmeters are built upon either the magnetic-vane or dynamometer principle. They are adaptable to both classes of circuits, that is, a reasonably accurate deflection can be secured with either direct current or alternating current. Direct-current instruments of the better class, however, are built upon the D'Arsonval galvanometer principle, which employs a permanent magnet between whose poles the movable coil swings. Therefore, when an alternating current is applied to a voltmeter of this type, it tends to deflect the needle first in one direction and then in the other, the result being that the needle does not deflect definitely in either direction, but vibrates for a certain range around the zero position. With the instruments of the magnetic-vane or dynamometer types, there is no permanent magnetic field. In the case of the dynamometer, when alternating current is used, the current through both coils changes at the same instant and, therefore, the resultant field is in one direction.

EFFECT OF ELECTRIC CURRENT ON TREES.—I have noticed that the electric wires passing through the trees in this city have rapidly destroyed them. A large number of cases which I have personally observed show that the trees gradually lose their vitality, and in a few months seem to be practically dead. To what kind of action is this due? Does the current destroy the cells of the tree?—A. P. H., Binghamton, N. Y.

It is very unusual for electric companies to run bare wires through the tops of trees, as they realize that there is apt to be considerable waste of current, due to leakage over the branches, especially in wet weather. When circuits must be run through a tree, they are usually protected by extra heavy insulation. There is not likely to be any damage to a tree except by continuous contact of unprotected wires with the trunks and crown branches of the tree. Proximity of the wires alone, even if they are unprotected, can do no damage to the tree. The action of electric currents on woody tissues has not been studied very fully to permit positive statements in regard to the exact effects which various currents have on different species of trees. It has been found that comparatively weak currents passed through living woody tissues produce no appreciable effect, while very strong and long-continued currents cause a cessation of vital action in the living cells, and, if continued through a sufficiently long period, death of the cells and of the entire plant may follow. The general effect upon living tissues of some trees appears similar to that produced by high temperatures of heat. It would be interesting to know in this particular case whether the wires were insulated or bare, and also whether or not the wires were in constant contact with the branches.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

INTERBOROUGH RAPID TRANSIT.

The report of the Interborough Rapid Transit Company, as filed with the New York Public Service Commission, for the quarter ended June 30, 1909, compares, by divisions, as follows:

MANHATTAN (ELEVATED) RAILWAY DIVISION.

April 1 to June 30:

	1909.	1908.
Earnings from operation	$3,676,209	$3,478,691
Operating expenses	1,527,023	1,634,770
Net earnings	$2,109,186	$1,843,920
Other income	90,169	135,053
Gross income	$2,199,355	$1,978,974
Deduct—Taxes on:		
Property used in operation	36,000	30,000
Earnings and capital stock	50,763	49,637
Other than above	350,000	320,000
Rentals	1,458,180	1,504,163
Net income	$ 304,411	$ 75,172

SUBWAY DIVISION.

	1909.	1908.
Earnings from operation	$3,180,639	$2,769,552
Operating expenses	1,129,292	1,161,331
Net earnings	$2,051,347	$1,608,221
Other income	253,041	170,254
Gross income	$2,304,388	$1,778,475
Deduct:		
Interest on funded debt	501,260	425,000
Taxes on property used in operation	18,000	15,000
Rentals	*546,354	*521,320
Amortization of debt, discount and expenses	3,036	†7,984
Net income	$1,235,737	$ 809,169

TOTAL INTERBOROUGH SYSTEM.

	1909.	1908.
Gross	$6,816,848	$6,248,243
Expenses	2,656,315	2,796,102
Net	$4,160,533	$3,452,141
Other income	343,210	305,308
Total income	$4,503,743	$3,757,449
Deductions:		
Taxes on property used in operation	54,000	45,000
Taxes on common and capital stock	50,763	49,637
Taxes on other than above	350,000	320,000
Interest on funded debt	501,260	425,000
Rentals	*2,004,534	2,025,483
Discount and expenses	3,036	†7,988
Total deductions	$2,963,595	$2,873,108
Surplus	1,540,148	384,341

*Rental due city of New York measured by interest and sinking fund on city bonds issued for construction of rapid transit railroad.
†November 1, 1907, to June 30, 1908.

BROOKLYN RAPID TRANSIT.

The New York Public Service Commission has issued the quarterly reports of the various companies in the Brooklyn Transit system for the quarter ended June 30, 1909. The statements of the principal four divisions of the system show as follows:

QUARTER ENDED JUNE 30, 1909.

	Brooklyn Heights R. R.	Brooklyn, Queens Co. & Sub. R. R.	Brooklyn Union Elevated R. R.	The Nassau Electric R. R.
Gross earnings	$1,829,936	$ 328,261	$1,881,347	$1,060,797
Operating expenses	1,292,263	241,500	1,029,750	781,111
Net earnings	$ 537,672	$ 86,760	$ 851,597	$ 279,686
Other inc.	18,735	13,452	40,885	39,643
Gross income	$ 556,408	$ 100,213	$ 892,482	$ 319,329
Total deductions, including taxes	651,574	121,599	537,247	266,380
Net inc. from all sources, surplus	*95,166	*21,386	355,235	52,949
Net inc. for previous qtr. of fiscal year	*42,871	*27,899	485,819	108,925
Surp. for 12 mos. ended June 30, 1909	*$ 138,037	*$ 49,285	$ 841,054	$ 161,874

Increases or decreases over the corresponding period of 1908:

Gross earnings	$ 36,312	* $149,521	$ 204,385	$ 205,320
Oper. exp.	151,680	*31,555	*167,222	232,677
Net earn.	*$ 115,368	* $117,966	$ 371,607	*$ 27,356
Other inc.	*4,954	1,507	6,154	5,024
Gross inc. from all sources.	*$ 120,322	* $116,459	$ 377,762	*$ 22,332
Total deduc., including taxes	48,800	6,827	53,736	4,116
Net inc. from all sources, surplus.	*169,123	*123,286	324,025	*26,448
Net inc. for prev. qtr. of fiscal year	*34,945	*193,798	*210,198	92,196
Surp. for 12 mos. since July 1	*$204,068	*$317,085	$ 113,827	$ 65,747

*Indicates deficits, losses or decreases.

PACIFIC GAS AND ELECTRIC COMPANY.

Lee, Higginson & Company, of New York, are offering California Gas and Electric Corporation (Pacific Gas and Electric Company) unifying and refunding mortgage five per cent sinking fund thirty-year bonds at ninety-six-and-a-half. In 1901 the corporation acquired substantially all the gas, electric-light and power plants of central California outside of San Francisco, and has since been consolidated with the Pacific Gas and Electric Company, which controls the San Francisco gas and electric systems. The entire funded debt on the properties is $35,153,000 and the physical valuation of the properties subject to the mortgage is approximately $35,000,000. The company has favorable franchises which extend well beyond the life of the bonds and shows net earnings of more than double all interest charges.

WESTERN UNION TELEGRAPH.

The Western Union Telegraph Company has issued its preliminary estimated statement of earnings for the quarter ended September 30, 1909. This compares with the actual figures for the same period of 1908 and 1907 as follows:

	1909.	1908.	1907.
Net revenue	$2,000,000	$1,864,955	*$ 311,493
Bond interest	433,062	433,062	433,062
Balance	$1,566,937	$1,431,893	$ 744,555
Dividends	747,486	497,820	1,217,025
Surplus	$ 819,451	$ 934,073	*$1,961,580

*Deficit.

The actual returns for the quarter ended June 30, 1909 (approximate previously published), compare as follows:

April 1 to June 30:

	1909.	1908.	1907.
Net revenue	$1,867,194	$1,579,660	$1,537,201
Bond interest	433,062	433,062	388,500
Balance	$1,434,132	$1,146,598	$1,148,701
Dividends	747,391	497,546	1,217,025
Surplus	$ 686,741	$ 649,052	*$ 68,324

*Deficit.

The figures for the present quarter ended September 30, 1909, not including the cost of construction or betterments, which has not been included in the regular quarterly reports, show a net profit of 1.57 per cent, or at the rate of 6.28 per cent per annum. Including the cost of construction or betterments, the net profit for the quarter is 1.11 per cent, or at the rate of 4.44 per cent per annum.

INTERBOROUGH RAPID TRANSIT ANNUAL REPORT.

The annual report of the Interborough Rapid Transit Company for the twelve months ended June 30, 1909, has been issued, showing earnings from operations of $25,775, 392, an increase of $1,716,093, or 7.13 per cent, the result of a gain on the subway division of $1,896,774, or 18.93 per cent, and a loss on the Manhattan division of $180,681, or 1.29 per cent.

During the first six months of the year there was a decrease in Manhattan Railway division earnings of $367,123, as compared with the corresponding period of the previous year, while during the last six months earnings increased $186,441.

The net earnings were $15,027,949, a gain of $1,691,344, or 12.68 per cent. There was an increase on the subway division of $1,772,468, or 31.67 per cent, which was partially offset by a decrease on the Manhattan division of $81,123, or 1.05 per cent.

The surplus after providing for seven per cent guarantee on Manhattan Railway Company stock and nine per cent dividend on Interborough Rapid Transit Company stock, was $1,439,823, an increase of $889,163.

The income account compares as follows:

	1909.	Increase.
Earnings from operation	$25,775,392	$1,716,093
Operating expenses	10,747,443	24,748
Net earnings	$15,027,949	$1,691,344
Other income	1,384,643	164,473
Gross income	$16,412,592	$1,855,817
Interest on bonds and three-year gold notes, rentals and amortization charges.	$ 5,822,962	$ 753,312
Taxes	1,799,807	213,341
Total interest, rentals and taxes	$ 7,622,769	$ 966,653
Balance	$ 8,789,823	$ 889,163
Manhattan guarantee (7% per annum)	4,200,000	.....
Net income	$ 4,589,823	$ 889,163
Dividend (9% for 1 year)	3,150,000	.....
Total	$ 7,350,000	.....
Surplus	$ 1,439,823	$ 889,163

Per cent expenses to earnings—		
Excluding taxes	41.69%	*2.88%
Including taxes	48.68%	*2.48%
Passengers carried	514,680,342	31,394,702
Daily average passengers carried	1,410,083	89,631

*Decrease.

In his report President Theodore P. Shonts says:

"The number of passengers carried on the subway division during the year increased 37,990,370, or 18.95 per cent, while on the Manhattan division the number of passengers carried decreased 6,595,668, or 2.33 per cent, the decrease in the latter being due primarily to the business depression prevailing during the first six months of the fiscal year. The increase on the subway was due in a large measure to the opening up and development of new territory.

"Your company owns and controls between four and five million dollars' worth of real estate not required for operating purposes. A considerable part of this real estate is owned by the Manhattan Railway Company, and under the terms of the lease the proceeds can only be expended for the payment of its obligations and in making improvements on its lines. All of this property will be sold from time to time, as favorable opportunity offers, and the proceeds applied for the corporate purposes of the respective companies. Several pieces of property not required for purposes of operation have been rented or sold on advantageous terms during the past year, and other sales and leases are in process of negotiation."

Touching the question of taxes, President Shonts says:

"The disproportion between the burden of taxation borne by the public service corporations of this and those of other states and between such corporations here and individual taxpayers is manifest. It is a serious obstacle in the way of the development of the rapid-transit facilities in this city. Indeed, no prudent plans for the development of these facilities can disregard the excessive taxes now imposed on traction properties in this city, or, in connection with the heavily increased cost of new construction, safely assume its burden."

BINGHAMTON RAILWAY.

The report of the Binghamton (N. Y.) Railway Company for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$74,925	$65,600
Total operating expenses	42,820	41,923
Net operating revenue	$32,104	$23,677
Outside operations (net)	983	637
Total net from operating	$33,088	$24,314
Taxes accrued	$ 3,792	$ 3,000
Gross income	$29,296	$21,314
Ttl. deductions from gross income	23,709	21,852
Net corporate income	$ 5,586	*$ 537

*Deficit.

WESTERN UNION TELEGRAPH COMPANY.

The following statement exhibits the condition of the company at the close of the quarter ended June 30, 1909:

Surplus April 1, 1909, as per last quarterly report		$16,582,537.25
Net revenues, quarter ended June 30, 1909		1,867,194.58
		$18,449,731.83
From which appropriating for—		
Dividend of ¾ per cent, paid July 15, 1909	$747,391.50	
Interest on bonded debt	433,062.50	
		1,180,454.00
Left surplus June 30, 1909		$17,269,277.83

The following statement exhibits the estimated condition of the company at the close of the quarter ending September 30, 1909:

Surplus June 30, 1909, as above		$17,269,277.83
The net revenues of the quarter ending September 30, instant, based upon nearly completed returns for July, partial returns for August, and estimating the business for September, will be about	$2,000,000.00	
Less interest on bonded debt	433,062.50	
Leaves estimated net earnings for the quarter, less interest on bonded debt		1,566,937.50
		$18,836,215.33
It requires for a dividend of three-fourths of one per cent on capital stock issued about		747,486.00
Deducting which, leaves a surplus, after paying dividend, of		$18,088,729.33

In view of the preceding statements, the committee recommended the adoption by the board of the following:

"Resolved, That a dividend of three-fourths of one per cent on the capital stock of this company be hereby declared payable on and after the 15th day of October next, to stockholders of record at the close of the transfer books on the 20th day of September, instant.

"Resolved, That for the purpose of the annual meeting of stockholders, to be held on Wednesday, the 13th day of October next, and of the dividend hereinbefore declared, the stock books of the company be closed at the close of business on the 20th day of September, instant, and be reopened on the morning of the 14th day of October next.

Second Avenue Suit Delayed.

Judge Lacombe handed down an order in the New York State United States Circuit Court in the suit of the Guaranty Trust Company for the foreclosure and sale of the Second Avenue Railroad of New York city, extending the time for the complainant to take its chief testimony in the case until thirty days after the service of notice by the solicitors for any of the defendants. The defendants are the Second Avenue Railroad, the Metropolitan Street Railway Company, the Norton Trust Company, the Pennsylvania Steel Company and the Degnon Construction Company.

When notice is served by solicitors for the defendants upon the complainant to begin the taking of testimony, the complainants have thirty days from the expiration of the time fixed for the taking of its testimony in chief, the defendants have thirty days' time thereafter for the taking of their testimony, and the complainants have thirty days further to take testimony in rebuttal. This order was granted by Judge Lacombe, despite his decision in July last that the Federal Court had no jurisdiction in the case for the reason that the receiver of the Second Avenue Railroad had been appointed by the State Supreme Court.

Subway Permit Amended.

The New York Public Service Commission has received a letter from Acting Secretary of War Robert Shaw Oliver, granting the petition of the commission for a change in the terms of the permit recently granted by the War Department for carrying the Broadway-Lexington Avenue subway in New York city under the Harlem River.

In the original permit it was required that not more than one-half of the tunnel should be under construction at one time. This restriction is now eliminated. The original permit also required that this city should be responsible for any and all damages that might be caused to navigation through the construction of the tunnel. This requirement is also eliminated, so that the contractors for the work will be responsible if they cause any such damage.

The Glace Bay Wireless Station Destroyed by Fire.

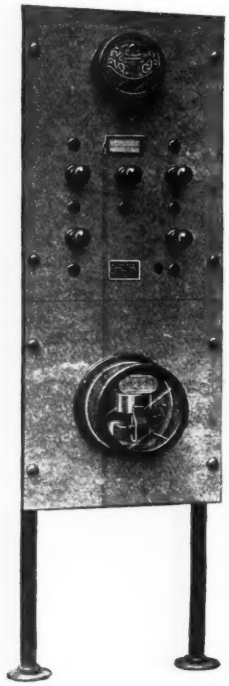
The destruction by fire last month of the Marconi wireless station at Glace Bay, Nova Scotia, is a great setback to the advancement of radiotelegraphy, as well as a serious blow to the Marconi Company. Fortunately, the towers, antennæ, boiler room and manager's house escaped, but inasmuch as the rest of the equipment was specially designed for this installation, the rebuilding will be delayed until new instruments can be made in Europe and imported. The loss in business may prove to be even more costly than the other material losses.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Series Alternating-Current Arc-Lighting System.

The rapid advance in the application of alternating current to electric lighting has brought forth a system for series arc lighting upon alternating-current circuits of constant potential. This system will be found to uphold in every way the high standard maintained by direct-current systems in the past. Although the direct-current series system is still popular, yet the fact remains that alternating current demands recognition for systems of arc lighting.



SWITCHBOARD USED IN SERIES ALTERNATING-CURRENT ARC-LIGHTING SYSTEM.

The Fort Wayne Electric Works, Fort Wayne, Ind., is offering a system for series arc lighting upon alternating-current circuits with a frequency of sixty or 140 cycles, comprising the following apparatus:

Constant-current regulators, constant-potential transformer, high-tension switchboard, constant alternating-current lamps and horn-type lightning arresters. The whole mechanism is mounted in a very compact manner upon a light cast-iron frame, designed to stand upon the floor in a position near the switchboard.

The principle upon which the regulator operates lies in the automatic variation of impedance in the lamp circuit. This variation is accomplished by the movement of a reactance coil up and down over one branch of a divided magnetic circuit. The regulator consists of a reactance coil supported in such a manner

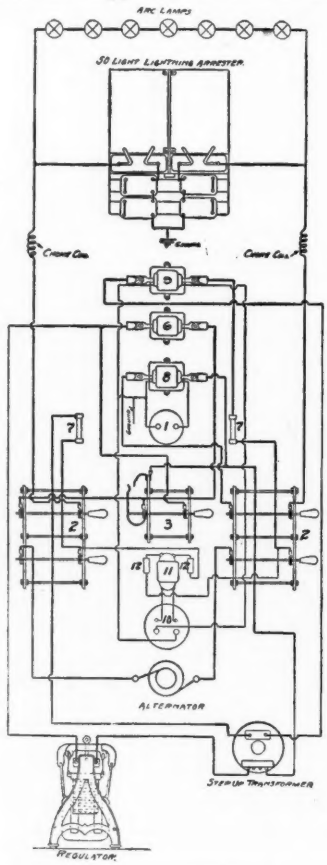


DIAGRAM OF CONNECTIONS WITH TRANSFORMER AND WATTMETER.

from a system of levers as to move freely over the center leg of a branched laminated core. The core is similarly supported from levers so that it may move freely in a vertical plane, thereby including a greater or less number of the turns of the reactance coil as the resistance of the external circuit is respectively decreased or increased. The reactance coil and core are connected with the levers in such a manner as to balance each other, one end of one lever being connected to the coil, while the other end of the same lever is connected with the iron core. With the levers thus connected moving about knife-edge fulcrums, both coil and core are maintained in equilibrium in all positions with the use of external counterbalancing weights.

It is possible to operate the series arc-lighting system from alternating-current distribution of any voltage entirely independent of any other load which the same distribution may be carrying. This is brought about by the introduction of a transformer which furnishes a suitable potential for the regulator circuit.

The use of this transformer with the

FORT WAYNE SERIES ALTERNATING-CURRENT, ENCLOSED ARC LAMP.

one-to-one ratio is advised for insulation purposes, especially where more than one circuit is operated from one set of busbars.

The switchboard illustrated herewith, is of highly polished blue Vermont marble, supported at a convenient height above the floor by means of a rigid iron frame and supplied with all the necessary meters and switches for the starting and operating of the series arc-lighting system. These switchboards are made with and without the sub-base and integrating wattmeters as may be desired. All boards carry the ammeter and card

receiver as shown in the accompanying cut. Switchboards for these systems are always installed in connection with transformers and are equipped with plug switches. These switches are of the type in which the circuit is closed by brass rods moving between contacts enclosed within a fiber tube projecting from the back of the board. Thus all breaks in the circuit are made within this tube, where no possible damage can be done by any slight arcing which may occur. All connections with line, regulator, reactance coil and meters are made entirely upon the back of the board with metal of sufficient cross-section to carry the small current required with no appreciable temperature rise.

Two lamps have been designed to meet this class of service, one to operate upon sixty-cycle circuits, while the other is adapted for circuits of frequencies varying from 125 to 140 cycles. One-half-inch by twelve-inch carbons are used, with the result that the lamp will operate under favorable conditions throughout a run of from 100 to 125 hours with one trimming. The appearance of this lamp from the outside is similar to that of the multiple-type alternating-current arc lamp and the direct-current series lamp.

The lamp is supported by means of a malleable-iron link, enclosing a porcelain insulator attached to the top of the hood.

The case which protects the mechanism of the lamp from both mechanical injury and the weather is cylindrical in form, having been rolled from heavy sheet copper, lapped together in a single riveted and firmly soldered joint. Upon the removal of this case all the mechanism of the lamp is exposed to view, all parts being easily accessible for adjustment.

Metal porcelain-lined reflectors are regularly supplied with these lamps as part of their equipment. The reflectors are designed to be attached to the lower edge of the case in the lamps by a very simple operation. These interfere in no way with the removal of the outer globe for trimming, since the latter is very quickly released from its bayonet support underneath the reflector, lowered entirely free from the inner globe and supported in such a position by means of a chain secured to the frame of the lamp.

In order to protect the secondary or line circuit of the series arc-lighting system from lightning discharges, and also from excessive voltage between the line wires, the lightning arrester supplied with this system is designed to be connected to the line wire just inside the building.

Detroit Ironclad Meter Box and Fused Switch.

The "Detroit" service and meter box has been designed by the Detroit Fuse and Manufacturing Company to meet the demands for one box that will serve as a main switch and cut-out, prevent theft of current and provide proper terminals for meter testing. This box is compact and substantial, yet allows plenty of room for wiring and testing, and complies with all requirements as to spacing.

The main switch and cut-out embodies the unique knife-switch mechanism of the "Detroit" ironclad fused switch, which is absolutely positive in its action. This mechanism is controlled by a plunger from the outside of the box and is believed to be the only switch that can be sealed against tampering and yet is instantly accessible to the consumer. The switch gives complete protection from moisture, dirt, fire and fumes. It offers a superior service switch on account of all live terminals being completely enclosed, there being no possibility of accidental contact in operating the switch. The fuses are mounted on the inside of the cover, swinging away from all live terminals when the cover is opened, and eliminating all danger when replacing blown fuses.

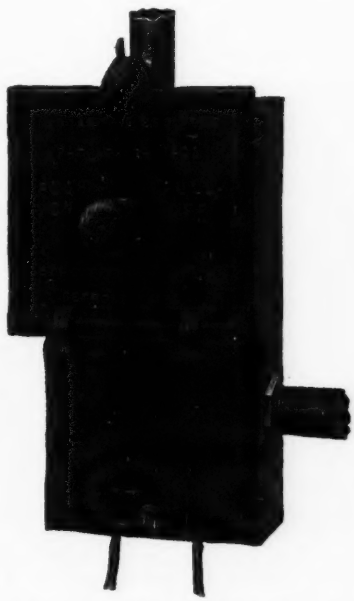


FIG. 1.—DETROIT METER BOX AND FUSED SWITCH.

The inspection or meter chamber at the bottom of the switch is provided with a separate seal, and provides for testing the meter without interfering with the service to the consumer and at quite a saving in time over old methods. This feature is of special value, as most lighting companies realize that the frequent testing of meters is decidedly advantageous, and the saving in time from using this device will soon pay for its cost.

Fig. 1 shows the switch as designed for entrance in conduit and open work after leaving the meter box. It is noted that conduit is also run from the meter box to the meter, positively preventing theft of current or tampering. The meter box is drilled on both sides, one side being plugged, making it possible to install the meter in any location.

Fig. 2 shows the mechanism of the "Detroit" ironclad fused switch, and it will be noted that the fuses are mounted on the switch blades, making this portion of the service box very compact. The mechanism is simple in construction, and the spring of sufficient strength to control the switch independent of outside pressure.

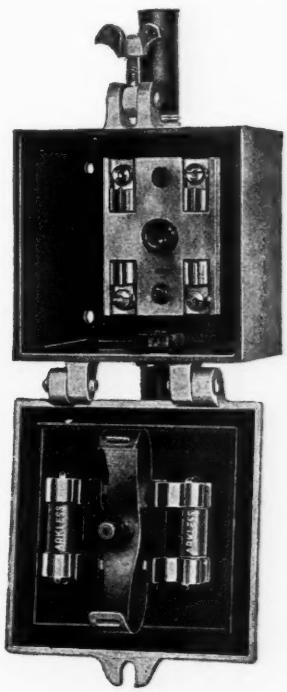


FIG. 2.—INTERIOR VIEW OF DETROIT FUSED SWITCH.

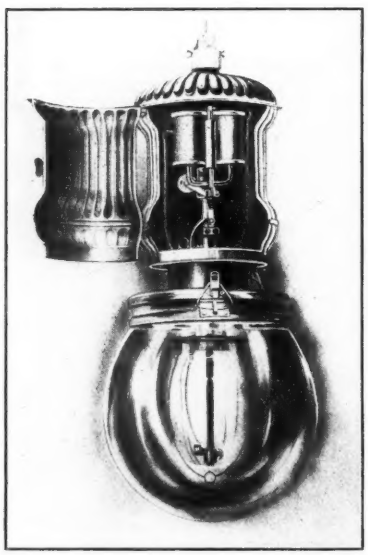
Westinghouse Turbo-Alternators.

The sheet and tin-plate mill of the new Aliquippa Works of the Jones and Laughlin Steel Company, on the Ohio River below Pittsburg, will be served with power to operate a number of direct-current motors, through a rotary converter, from a 500-kilowatt, 6,600-volt, three-phase, sixty-cycle turbo-alternator of Westinghouse make.

The fuel used in the boiler plant will be coke-oven gas, and the turbine will operate on a steam pressure of 150 pounds, exhausting into a vacuum of twenty-eight inches.

A New Westinghouse Series-Multiple Direct-Current Arc Lamp.

Series-multiple arc lamps have proved a very convenient and satisfactory means of illumination for places where only constant-potential circuits are available. They are adapted for connection in series groups across 220 and 500-volt circuits, and this use makes it possible to operate arc lights with their many inherent advantages, in places where the supply voltage is determined by other considerations. In factories, 250-volt systems are frequently installed for furnishing power to motors, and in pleasure parks and other places that are supplied by trolley voltage, potentials of about 500 volts are common. For service in such places the series-multiple arc lamp finds a wide field of usefulness.



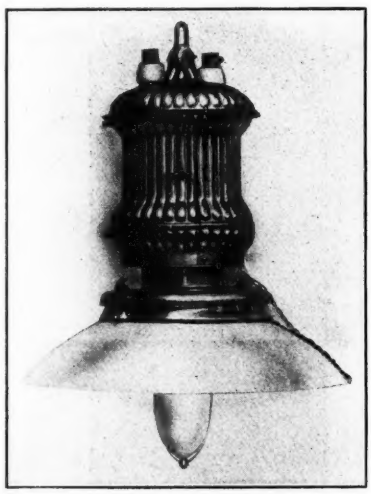
WESTINGHOUSE SERIES-MULTIPLE ARC LAMP FOR OUTDOOR USE.

The Westinghouse Electric and Manufacturing Company has been active in perfecting this class of lamps, and has recently brought out a new and interesting type. It is self-contained, that is, it has no external resistance that ordinarily must be mounted separately from the lamp. The mechanical development has been in the direction of simplification and the reduction of the number of parts, yet producing a lamp that is automatic and reliable in its operation.

The moving parts of this lamp are made of solid brass, and will not rust and stick, as iron parts do. Other details of construction are correspondingly strong and durable, the insulation being fireproof and the circuits so arranged that the points of potential stress are few and well spaced. The lamp case is made in sections of high-grade sheet copper pressed into a fluted form with outlines pleasing to the eye. One-third of the case can be swung open, making the mechanism readily accessible. This feature, together with the small number and durable nature of the working parts, tends to lower maintenance costs.

All the characteristics of primary importance—prompt and silent starting and steady burning—have been successfully attained in this type of lamp. Since best results are obtained with an eighty-volt, five-ampere arc, the lamp resistance is made adjustable, so that the lamps may be connected two in series on 220-250-volt circuits, or five in series on 500-550-volt circuits.

These lamps are designed for operation in series groups, and if, for any reason, one lamp has its arc broken, an automatic cut-out switch short-circuits the mechanism, thus protecting the shunt coils and inserting an equivalent resistance. This enables the other lamps in the group to operate normally.



WESTINGHOUSE SERIES-MULTIPLE ARC LAMP FOR INDOOR USE.

Next Best Thing to Individual Motor Drive.

When a machine shop is fitted with line shafting and countershafting, and driven by a main engine, there is always a great deal of power lost in friction when only a portion of the machinery is to be used, as in working overtime. The Dodge Manufacturing Company, of Mishawaka, Ind., has contrived to do away with a great portion of this loss by making the machine-shop line shaft in sections connected by clutches. Any of these isolated sections can be driven by a portable motor which can be moved about the shop by the traveling crane and fastened to the floor in any desired place. In this way only that portion of the line shafting is driven which is actually needed for a group of tools on an overtime job.

A Novel Fixture Design.

In the endeavor to produce lighting fixtures having both original and artistic merit, the Mitchell Vance Company, of 836-38 Broadway, New York city, has perfected the novel electrolier illustrated herewith. This fixture has a length of fifty-five inches and a spread of twenty-four inches.

MITCHELL VANCE FLORAL EFFECT ELECTROLIER

The design is made up by using a knotted ribbon in metal terminating in two pendent tassels; through the knot in the center of the ribbon is arranged a cluster of arms made of overlapping leaves of a cornucopia or horn-of-plenty shape, into the ends of which are inserted glass shades representing fuchsias. These shades are of various colors, with a crystal matt termination at the ends of the leaves. The shades carry within them eight-candlepower frosted miniature lamps. The whole fixture is suspended by a woven rope and tassel stem from the canopy which attaches to the ceiling. The metal work of this chandelier is finished in a soft dull matt gold color, giving it a very rich and artistic effect.

This company is making electroliers in many similarly original designs.

Bristol Portable Electric Pyrometer with Thermo-Electric Couple.

The Wm. H. Bristol electric pyrometers have become well known in many processes where temperatures lower than 2,000 degrees are used. These pyrometers have been made in both switchboard and portable form to indicate or record high temperatures, but most of the instruments now in service are for ranges of temperature lower than 2,000 degrees. There are quite a number of processes in

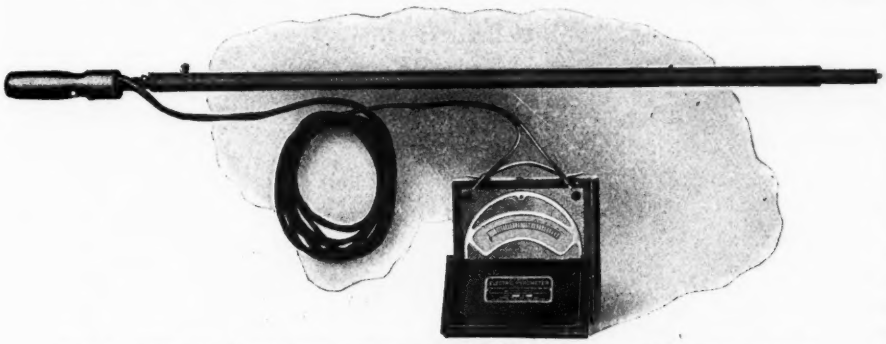


FIG. 1.—BRISTOL PORTABLE PYROMETER WITH THERMO-ELECTRIC COUPLE.

which excessively high temperatures are used and these temperatures should be measured intermittently in order to make control possible and to obtain a uniform product. In experimental work temperatures in the neighborhood of 25,000 degrees Fahrenheit should often be measured as, for instance, in boiler tests where the boiler-furnace temperature is to be determined.

A new quick-reading form of these pyrometers has been designed and pre-

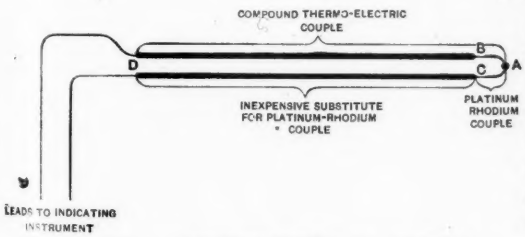


FIG. 2.—CONSTRUCTION OF THERMO-ELECTRIC COUPLE.

liminary models tested in actual service in several different processes where the temperatures are excessively high and the requirements very severe. This special pyrometer consists of a patented compound thermo-electric couple used in connection with a special portable instrument equipped with a pivot jewel-bearing Weston movement. The complete outfit is shown in Fig. 1.

The thermo-electric couple is shown externally in Fig. 1, this being a view of the couple with the protecting sheath pulled back against a stop, leaving the tip of the thermo-couple exposed. When a reading is to be taken with this special thermo-couple it is inserted into the furnace or kiln, with the tip protected from mechanical injury, and as soon as the couple has been inserted at the proper point in the kiln the iron pipe-protecting sheath is slipped back so that the tip is exposed to the hot gases whose temperature is to be measured. After a reading has been taken the couple should be quickly withdrawn and partially cooled off before another reading is taken.

This form of couple is the invention of Prof. Wm. H. Bristol, formerly of Stevens Institute and now president of the Bristol Company. United States patents were issued July 5, 1904, and August 29, 1905. The compound construction of this couple is shown in Fig. 2. The point A corresponds to the regular junction of an ordinary thermo-couple and the two elements which join at the point A are platinum and platinum-rhodium, this being the particular couple selected as a standard by the German government. The platinum and platinum-rhodium elements extend to the points B and C, where they are welded to two other wires made of inexpensive alloys, which are such that the electromotive forces generated at B and C are practically equal and opposed when these junctions are both exposed to temperatures not higher than 1,200 degrees Fahrenheit. These inexpensive alloy elements are extended to the point D, which is the cold end of the couple.

This construction of the quick-reading couple is such that the platinum-rhodium tip of the couple A may be exposed to excessively high temperatures up to 3,000 degrees Fahrenheit without having the temperature of the junction B and C exceed a safe limit. The temperature at A may be quickly measured with this special couple, as the platinum-rhodium tip is exposed directly to the hot gases in the furnace or kiln. In this way an inexpensive substitute is provided for the expensive platinum-rhodium couples previously employed for the measurement of such high temperatures.

This quick-reading form of the Wm. H. Bristol electric pyrometers, with the patented compound couple, has been tested under very severe conditions and found extremely valuable for such applications as brick-kiln temperatures, boiler-furnace firebox temperatures, by-product coke-oven combustion-flue temperatures, soaking-pit temperatures, etc. The complete outfit is portable and readings of temperatures in the neighborhood of 2,500 degrees may be obtained in a very few seconds after inserting the tip of the couple to the point where the temperature is to be measured. By using a special form of the platinum and platinum-rhodium tip this type of thermo-couple can be used to measure the temperature of red-hot surfaces of metal or other material.

DuBois Single-Cylinder Throttling Gas Engines.

The DuBois Iron Works, DuBois, Pa., is placing on the market a new single-cylinder throttling gas engine suitable to be operated by natural, illuminating and producer gas and gasoline. As this engine is a departure from the regular type of engines manufactured by this company, a brief description of it will prove interesting.

An engine of high economy, together with low fuel consumption, has been obtained without complicated engine construction, and an idea of its simplicity may be gained from the accompanying illustration. The massive iron base, so essential to the operation of single-cylinder engines, gives support to the cylinder two-thirds of its length, and this, in addition to the cylinder's being carried half the diameter into the base, makes it a straight-line machine and insures rigidity and perfect alinement.

The cylinder barrel with the water jacket is cast in one piece. The water compartments are segregated by longitudinal rods, so designed that free expansion is allowed immediately surrounding each end of the cylinder when the explosion takes place. These rods further provide for taking up a portion of the strain on the inner shell, and also serve to distribute the cooling water uniformly

throughout the entire length of the cylinder.

The lay shaft is the means of operating the valves, electric igniters and governor. It is supported along the side of the cylinder in babbitted bar brackets, and runs parallel to the center of the engine. It is driven by cut spiral gears, which run in an enclosed oil bath, that reduces natural wear to the minimum and leaves the operation noiseless.

A governor of the fly-ball type is employed. Its spindle is driven through cut spiral gears from the lay shaft, and the balls and sliding member are enclosed in a stationary housing. The governor gears are located between the forward cam and the main shaft or between two lay-shaft bearings, consequently the angular velocity of the governor is not disturbed or made irregular by the tensional yielding of the lay shaft to the stresses imposed by the cams and the valve mechanism.

The igniter is of the make-and-break type, located in the cylinder head, and is operated by a push rod connected to a small crank pin on the shaft and so arranged as to be adjustable for early or late ignition by means of a hand lever. This lever raises and lowers the horizontal finger with the bent end, which trips the igniter, and thereby alters the point of firing.

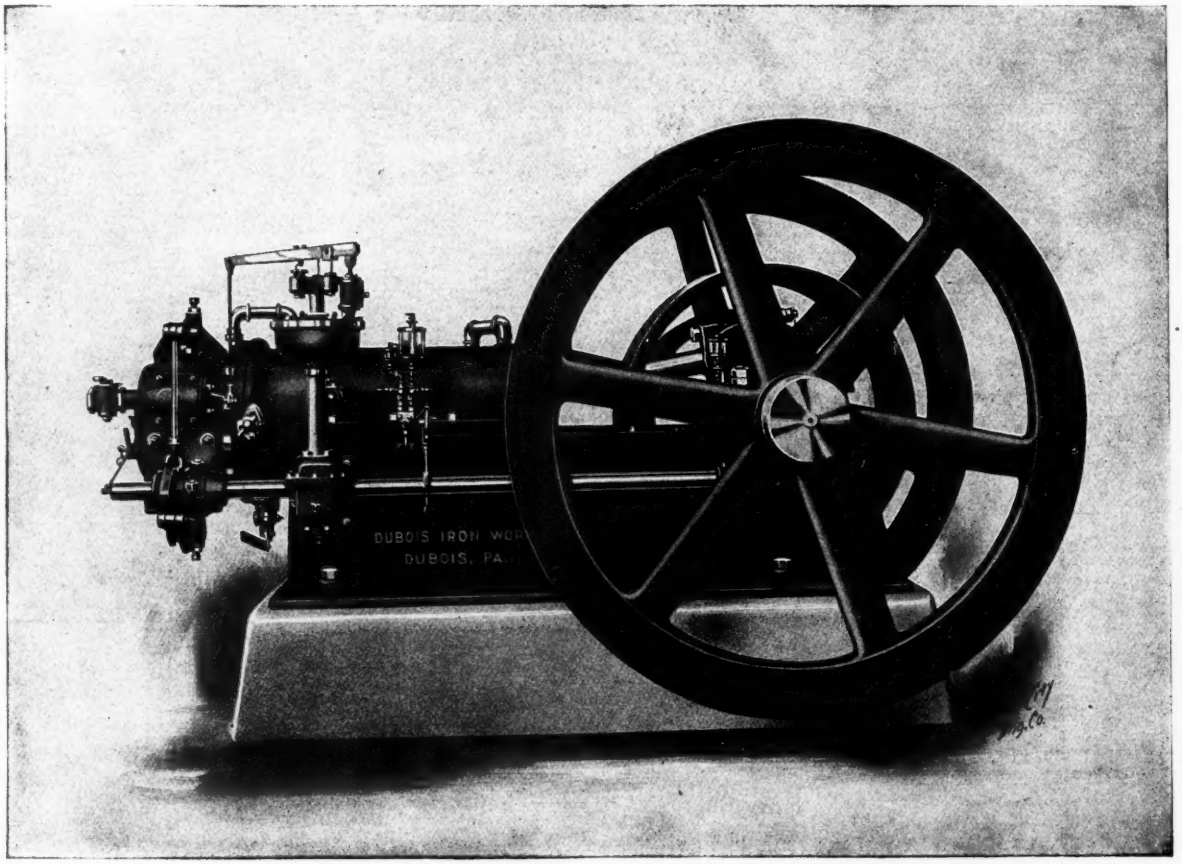
The fuel supply to the cylinder is controlled by means of an improved type of rotating throttling valve, located in the gas supply passage and operated from the governor. The gas entering from this rotary valve passes directly to the main inlet or mixing valve, and is admitted to the cylinder through a series of round holes drilled through the inlet valve seat. The gas coming in on one side and opposite to that of the air, and both being drawn in through the numerous holes in the inlet-valve seat, thoroughly mixes and combines the two, making possible a powerful explosion.

The piston is of the trunk type, and is equipped with four cast-iron spring rings.

The portion of the piston that is exposed to the explosion is designed with a convex head, which demands that contraction and expansion act on the piston uniformly.

The crank shaft, crank cheeks and pin are made in one piece, a solid steel forging, and the balancing weights are bolted on. The main bearings are lined with genuine babbitt and are adjustable by means of liners.

The inlet and exhaust valves are of the small poppet type and are carried in the cylinder head and operated vertically. Each valve is operated mechanically by means of the cam on the lay-shaft push rods and rocker arms. These push or valve rods are right-and-left-hand threaded, so that adjustment for natural wear can be made while the engine is running. Roller contacts are provided to take the thrust of the cam and to deliver the motion of the rocker arm to the valve stem.



DU BOIS SINGLE-CYLINDER THROTTLING GAS ENGINE.

The auxiliary exhaust is a series of round holes drilled through a rib connecting the water-jacket wall to the cylinder barrel, on the left side of each cylinder, the holes being drilled instead of cored, in order to obtain absolute accuracy in dimensions and location. These openings are not uncovered until the exploded charge in the cylinder has expended its full force in power and the piston has completed its expansion or forward stroke. Immediately thereafter, the auxiliary exhaust port is uncovered, and the greater percentage of exploded gases escape to the muffler, the remaining being discharged through the main exhaust valve.

New Type of Self-Restored Magneto Line Signals.

The Western Electric Company has recently introduced an improved form of self-restored line signal and associated jack which overcomes many of the objectionable features that are inherent in those types which employ a form of drop shutter for a signal. This new piece of apparatus is known as the No. 2 combined jack and signal. Fig. 1 shows a strip of five of these.

The signal consists of an indestructible steel ball which is mounted on a pivot. The upper half of this ball is covered with a black enamel, and the lower half with red enamel. When in an inoperative position, only the black surface of the ball shows through the opening of the face-plate and when in an operative position only the red surface of the signal ball is in view. This steel ball is counterbalanced in such a way that when the armature is attracted the ball is allowed to revolve through nearly 180 degrees. The signal is restored to its normal position by the act of plugging in to answer a call. The plug, when inserted in the jack, acts directly against a lever which engages a projecting lug on the target, which causes it to revolve back into its normal position.

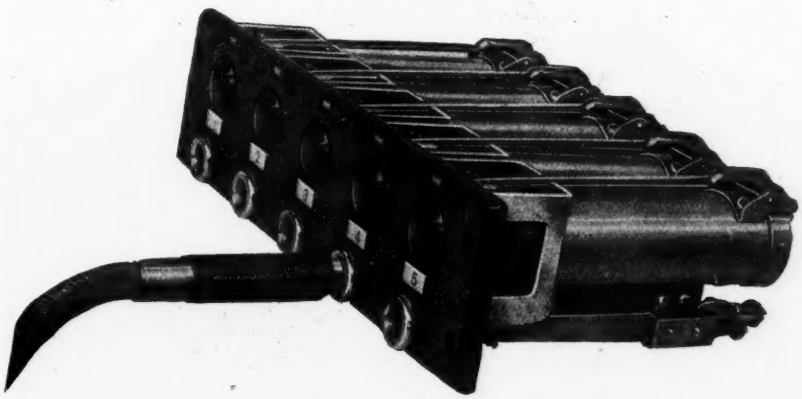


FIG. 1.—WESTERN ELECTRIC COMPANY'S NEW COMBINED JACKS AND SIGNALS.

A few of the novel features of this piece of apparatus are as follows:

The red spherical target, which is displayed when the signal is operated, resembles the lamp signal of the central-battery system and almost equals it in signaling qualities.

Due to the fact that the spherical target of the signal extends a portion of its surface through the face-plate, it can be easily seen from the side as well as from the front of the switchboard.

On account of this signal ball having a smooth spherical shape, it avoids interference with the operator's cords and injury to the operator's hands or clothing.

Since the signal ball is made of punched steel, any amount of impact with the operator's plugs will not injure the target or interfere with its adjustment or render it inoperative.

The restoring mechanism and all of those parts which are subject to injury from impact with the operator's plugs are placed back of the face-plate out of the way of injury.

The surface of this spherical target is covered with an indestructible enamel which will stand any amount of impact with the operator's plugs. Especial attention has been given to the night-alarm contacts. This circuit is completed by means of a pair of flexible german silver springs having pure platinum contacts. These springs are so placed that they are positive in action, not subjected to mechanical injury, and are accessible for inspection and adjustment.

FIG. 2.—METHOD OF REMOVING COIL.

These night-alarm springs are shown in Fig. 1.

It will be noted from Figs. 2 and 3 that in order to remove the coil it is not necessary to break any wire or clip connections.

This is accomplished by simply removing one screw. In removing a coil the fixed relation of these parts which maintain the adjustment of the signal is in no way disturbed.

These signals are furnished with coils of different resistances. All coils are interchangeable.

All coils are wound with black enamel insulated wire. This insulation is less affected by heat than silk, which is ordinarily employed for this purpose, and also its insulation properties hold up better where there is an excessive amount of humidity.

These signals are provided with a small rectangular type of indicator, which audibly and visually receives signals from the subscriber after the spherical target has been operated. This feature is extremely

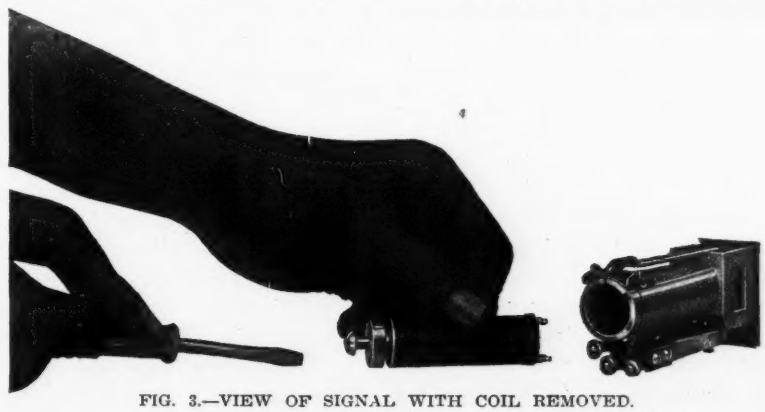


FIG. 3.—VIEW OF SIGNAL WITH COIL REMOVED.

desirable on non-selective party lines on which code ringing is employed.

The No. 2 combined jack and signal is furnished on individual mounting strips and also on strips with five.

The jacks that are associated with these signals are regularly made up having a single-break contact for ordinary lines and double-break contacts for bridging toll lines. The signal is also made up with an audible-code ringing attachment which consists of a relay type of contact that closes a local bell circuit each time that a code signaling impulse is received.

To Increase Trade with the Latin-American Republics.

Statistics for 1907 show that the total foreign trade between Latin America and the United States in that year amounted to $558,000,000—about one-fourth only of the total foreign trade of the sister republics. Moreover, the balance of trade is against the United States to the extent of about $78,000,000 a year. This, therefore, all goes to show what a field there is for development with the republics of the south.

In order to increase the sale of American engineering products in the Latin-American countries, Alfred J. Thompson, 71 Broadway, New York city, has formed an expert selling organization to hustle for business in this rapidly developing section. During the past sixteen years Mr. Thompson has lived in and traveled extensively through Cuba and every republic of South America and has established most pleasant personal relations with the largest consumers in these localities. He finds, however, that one of the principal reasons for this country not getting its full share of this business, especially in the mechanical and machinery lines, is the fact that the agents or representatives do not appear to have sufficient technical training or knowledge of either United States shop conditions of manufacture, or the "duty" of the machinery required. The few American salesmen who have attempted to canvass this extensive and profitable trade have generally been commission men with too varied a line, including such unmechanical articles as lard, dry goods, drugs, etc., and it stands to reason that a provision or a dry-goods man is not apt to forward a very intelligent specification for a lathe, a mining pump, or for railroad supplies.

Mr. Thompson has associated with him in his new enterprise a number of graduate engineers, each one of whom makes his permanent residence in a principal city in the Latin republic or section he will cover as his territory, and who is therefore well acquainted with the conditions of service and the technical requirements thereof. Frequent visits are made by these men to the large mining plants, railroad shops and other actual and prospective users of American products.

The organization will have its headquarters in New York and Mr. Thompson will make periodical trips to these countries to call on his resident representatives and secure advance information bearing on local conditions.

His traveling associates all speak Spanish, and have had extensive shop training in the United States and selling experience in Latin America, and Mr. Thompson's plan should meet with the approval of every wide-awake concern with progress and expansion for its motto.

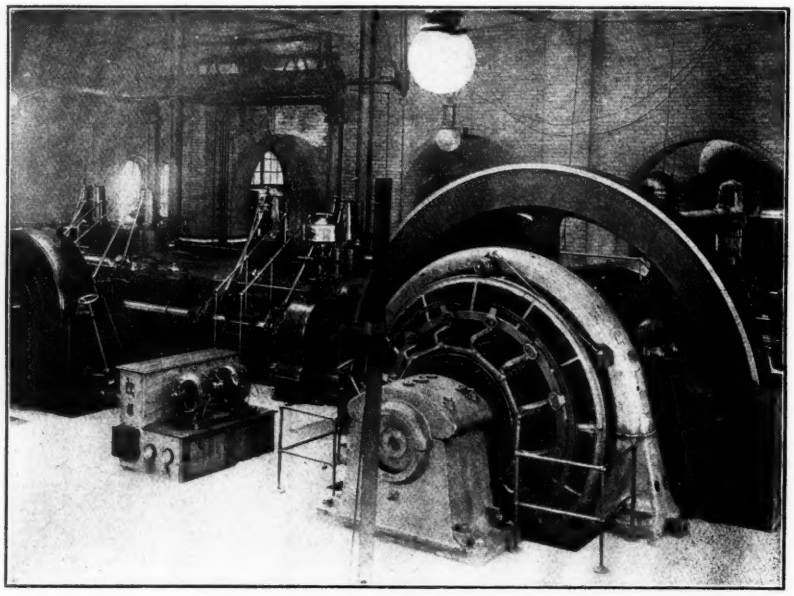
Galveston to Use Arch Lighting.

The first electric arch erected in Galveston, Tex., at the corner of Twentieth and Market streets, has been offered to the city by the citizens who installed it, provided the city will undertake to light it. It is a permanent arch of metal, equipped with 116 two-candlepower ten-volt incandescent lamps, and is very handsome and costly. A movement is on foot to make Galveston as well lighted a city as it is now poorly lighted. The current consumed by the arch is but little more than that taken by the arc lamps it is designed to replace.

Gas Engine Installations Aggregating 210,000 Horsepower.

In the accompanying illustration is shown an Allis-Chalmers horizontal, double-acting tandem gas engine, of 500 horsepower, driving a direct-current generator of the same company's build in the power house of the Illinois Steel Company's Bay View Mills at Milwaukee, Wis. During the two years this has been in operation the unit has not cost $50 for repairs, and its record has been such as to demonstrate conclusively the reliability of gas engines, properly designed, for industrial service of the most severe character.

Machines in operation for about the same period of time, or longer, include gas engines and generators of from 300 to 5,000 horsepower capacity, which, with others now going into commission, furnish power for iron works, steel mills, clay-products plants, cement mills, automobile shops, plate-glass works, tube mills, wireworks, central power, lighting and traction stations, phosphate plants, factories and other industrial establishments. In the list are engines operating on producer, natural and furnace gas, and their capacity for continuous service aggregates no less than 210,000 horsepower Among the larger users of gas power in the industrial field is the Pittsburg Plate Glass Company, which was one of the earliest to install the improved type of engine and electric generator built by Allis-Chalmers Company, and has just placed an order for the eleventh of these units.



ALLIS-CHALMERS DOUBLE-ACTING TANDEM GAS ENGINE, 500 HORSEPOWER.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, SEPTEMBER 6.—The annual report of the British Thomson-Houston Company, which is just issued, states that the firm sold Curtis turbines during 1908 of an aggregate capacity of 15,000 kilowatts, and that, since the accounts were closed on March 31, the number of machines of this type sold amounts to a capacity of 18,569 kilowatts.

Recent shipping disasters have once more brought prominently to the fore the question of the compulsory use of wireless telegraph apparatus on all vessels. In the House of Commons this week, the president of the Board of Trade stated that consideration had been given to the proposition by the Board, but it was not deemed advisable to take any action in this direction at present. It is quite possible that in the absence of government action the desired end will be brought about by the action of the underwriters, who propose that smaller insurance rates should hold where a ship is fitted with wireless. The cost of installing the apparatus, of course, is the obstacle to universal use of wireless apparatus, especially on those vessels where there would be no return from messages transmitted to and from the vessel, such as cargo boats, but efforts are being made to overcome this drawback by the design of a cheap set which can be manipulated by one of the crew. Mr. Marconi, in an interview with a daily newspaper representative over here, has given the exact terms upon which the Marconi Company supplies wireless installations upon the big liners, viz., $1,000 per annum, including the operator, and it is obvious that these terms are far too onerous in the case of cargo boats pure and simple. A bill for the compulsory use of wireless on French boats is said to have been introduced into the French Chamber.

The accounts of the working of the Pacific Cable for the year to March 31, 1909, again show a large deficit after meeting capital charges. As a matter of fact, there is a credit balance of about $35,000 as between the actual receipts and expenditure, but the amount necessary to cover interest and sinking fund charges is about $390,000. The revenue was about $15,000 better than in the previous year, and was $25,000 better than the estimate arrived at at the beginning of the year. During the year there were 232,304 ordinary messages transmitted, 9,086 government messages and 2,532 press messages, the figures for the previous year being, respectively, 238,088, 8,310 and 3,193. The total number of messages transmitted during the year under review was, therefore, 243,922, against 249,590 in the previous year, the first time since the opening of the cable in 1902 that there has been a falling off compared with the previous year. The report states that improved methods of increasing the duplex speed of the Bamfield-Fanning section have met with great success, and this cable, laid with the anticipation that the speed would not, in actual practice, exceed 65 letters per minute, is now daily working at a speed of from 90 to 97 letters per minute.

The increasing use of electricity in mines and its rapid development during the past few years has naturally resulted in a number of accidents, some of them fatal, mainly owing to faulty installation work or wilful disregard of regulations. As the present regulations apparently are not sufficiently wide to cover all possible cases, in the light of five years' experience, the government have decided to appoint a commission to go into the question of making modifications and alterations in the present code. It is a startling fact that under the dangerous conditions of mine working apparatus of the most careless design has been installed and only a fatal accident has revealed its presence to the inspectors. It is clear that a most systematic inspection of all colliery electrical equipments will have to be made by the Home Office department having charge of this work.

The working of the Underground Electric Railways Company, of London—which controls the Speyer group of tube railways and the District Railway in London—for the first half of 1909 shows the considerable loss of $80,000. This, however, is a considerable improvement upon the results of previous half years, and was foreshadowed by the satisfactory reports issued a few weeks ago by the affiliated tube railway companies. In fact, the actual return upon the investments in the tube railways for the past six months represents about 1¼ per cent. At present the total debit balance of the company amounts to $140,000, and the attempt to put the working of London's underground railway upon a satisfactory basis has certainly proved a much more formidable task than was ever anticipated by the late Mr. Yerkes when he first tackled the problem.

The shadow of forthcoming events may possibly be discerned in applications to amend some of the original metal-filament lamp patents. In connection with a purely British-made lamp and British patent, one infringement action is pending and presumably others are threatened. In the meantime, the action for infringement of the Bremer arc-lamp patent, which was heard some time ago, has not yet been adjudicated upon. The long vacation having commenced before the judge could prepare his judgment, it will now be quite a considerable time before the case is disposed of in the court of first instance. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, SEPTEMBER 5.—Among the new electric-lighting projects in France, I note the following localities which are making arrangements for lighting stations: Dun-le-Palleteau, Dozulé, Ferté-Macé. At Nimes there are being carried out some improvements in the city tramway system. The Municipal Council of Ballon d'Alsace is considering a project for electric tramways in that locality, part of the capital to be furnished by the town and the remainder by the company which is to receive the concession. This latter company intends also to install a traction line from Barr to Odilienberg during next year.

The municipality of Berne, Switzerland, is taking measures to secure a supply of hydraulic power for lighting and motors for the city and suburbs. It is likely that a turbine station will be erected on the Aar River and the site will be chosen between Niederuntigen and Wileroltigen. The Aar stream will afford a seventy-foot head of water in this locality, and it is intended to secure from 8,000 to 10,000 horsepower. The capacity of the machines to be erected in the plant will be from 12,000 to 15,000 horsepower. The tail race will empty into the Aar Canal.

In order to secure the current which is needed for the proposed electrification of different sections of the Austrian State Railroads, there is to be erected a hydraulic plant of some size, and it will be located near the town of Pinegg. The barrage will be an extensive piece of engineering work, and will be 0.8 mile in length, according to the present plans. The stream known as the Brandenberger Ache is to be utilized in this case, and it will afford a 600-foot head of water. In this way there will be obtained from 10,000 to 15,000 horsepower for the station.

In Austria there is to be run an electric automobile service from the town of Pozsony to the suburbs, using the trackless trolley method. What is known as the "Mercedes-Stoll" system is to be used for this line. Such a system is stated to cost only one-fourth of what would be needed for an electric traction line. The overhead trolley line is run double throughout the whole course, so that the cars are not obliged to stop on the road. A type of 20-horsepower motor is used on the cars. A. DE C.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, SEPTEMBER 13.—Over six hundred householders of the city of Winnipeg are unable to use electric current to light their homes because of the litigation between the city and the Winnipeg Electric Company. These six hundred homes are now using oil lamps and it is doubtful if the ruling of the courts will be obtained for some time, as both sides are determined to appeal to the highest courts. The city's statement of claim was filed on November 12, 1906, and there is but little prospect of the case coming up this year. The trouble started in 1904. A livery barn sued the city for $16.50 damages resulting from one of their livery rigs falling into an excavation on the street which was not properly guarded. The permit for the excavation was obtained by the Manitoba Gas and Electric Company, since absorbed by the Winnipeg Electric. The city endeavored to make the company a third party to the suit, but the application was opposed on the grounds that at the time the suit was started there was no such company as the Manitoba Gas and Electric Company, all its holdings having been absorbed by the Winnipeg Electric. The Manitoba Gas and Electric Company is the only company which ever made a contract with the city to supply gas and electric light. On the ruling the city did not know who it was dealing with. Suddenly the city solicitor informed the city engineer he was issuing permits for the erection of light poles to a company which did not exist. The city solicitor then notified the Winnipeg Electric that it had no right to bring power into the city without the consent of the civic authorities. The company, however, brought in the power and sold it despite the fact its power plant was some miles out of the city, while the by-law relating to the company provides that all its works must be within the city limits. The city then stopped issuing permits for the erection of poles. The last two weeks has been

devoted to arguments between the company and the city, with the result the city has ordered the company to supply light to those desiring it and the company has issued an ultimatum to the city that it will at once proceed with the erection of poles without going through the formality of taking out permits, in fact since this ultimatum the company has erected a number of poles, but the city has made no move. A long drawn-out legal fight is expected and the probabilities are it will be taken to the House of Lords in England for final settlement.

Great things are being planned in connection with the municipal electric railway system jointly owned by the cities of Port Arthur and Fort William, in Western Ontario. In Port Arthur construction will be started at once on new carbarns, while the City Council is endeavoring to organize a company to build extensions throughout several of the adjoining townships, the system to operate in conjunction, and auxiliary to, the municipal system. In addition several extensions are being planned to be built in the two cities. Port Arthur offers to assume sixty per cent of the burden of the indebtedness of the new company. Address J. J. Carrick, Port Arthur, Ont.

A statement has been issued by the British Columbia Electric Street Railway System showing the work done and the money expended since the company entered into an agreement with the city of Vancouver in 1900. The money spent is but $50,000 short of six millions, which provided for a considerable amount of new tracking, besides a power and light system at Ladner, a power development at Lake Buntzen which cost $2,000,000 and approximately 100 miles of extensions. The company proposes to spend large sums on development work in the immediate future and during the present month has placed in the London market bonds to the value of $2,500,000. R. H. Sperling is general superintendent of the company with head office at Vancouver, B. C.

The entire telephone system of the Temiskaming & Northern Ontario Railway between North Bay and New Liskeard, in Western Ontario, is being reconstructed and several important extensions will also be made this fall.

It is expected that the Dominion Government telegraph line from Athabasca Landing to the Lesser Slave Lake, in Northwestern Alberta, will be completed this fall.

The City Council of Vancouver, B. C., has passed a resolution in favor of engaging an engineer to report on the available water powers in the vicinity of the city. The Burrard Power Company has offered its plant to the city for $150,000 and the British Columbia Electric Company has also made an offer. The city proposes to go into the municipal power business. Address Alderman Goodman.

Charles Mitchell, C. E., Toronto, Ont., who was engaged by the City Council of Prince Albert, Sask., to survey the waterpowers to the north of that city, has reported that there is at least 10,000 horsepower available for development in the vicinity of the city. In three miles of the river there is a drop of thirty feet.

W. H. Hayes, chairman of the Manitoba Telephone Commission, announces that the province of Manitoba has been divided into seven districts for the purpose of better operating the government telephone system. There are six provincial districts, the seventh being Winnipeg. In each division there will be three managers, one each for the traffic, commercial and plant. These managers will be directly responsible for everything in their department to three superintendents, who will have their headquarters, and they will report to the commission. The system was inaugurated on September 1 and is already proving a success.

At Calgary, Alta., the pay-as-you-enter cars have proved very popular and the City Council considers they have been so successful that six more cars will at once be ordered. Incidentally the system is a financial success, but the motormen and conductors who are now receiving twenty-one and one-half cents per hour have demanded an increase to twenty-five cents, which has been refused, as there are three applicants for every position now held on the system. R.

IMPORTANT DEVELOPMENT.

(Special Correspondence.)

TEN-MILLION-DOLLAR TRACTION LINE — Announcement has been made by Samuel M. Clement, Jr., an attorney, that the Kentucky Rapid Transit Company, with a capital of $10,000, has been chartered at Dover, Del., the corporation being authorized to take over traction companies in Kentucky. The principal operations of the company at present, it is stated, will be in Louisville, Lexington and Frankfort. The company, which was organized by Boston, New York and Philadelphia capitalists, is also authorized to operate electric light and gas plants. The directors and officers of the company will be chosen on September 28.

LIGHTING AND POWER.

(Special Correspondence.)

ST. PETER, MINN.—The extension of the municipal lighting plant to Kasota has been completed and is in successful operation. C.

UNION, ORE.—This city has voted to issue bonds for the erection of an electric-lighting plant.

FRIDAY HARBOR, WASH.—A light franchise has been granted to the Western Mills and Lumber Company. U.

FARGO, N. D.—The Union Light, Heat and Power Company has reduced the price for electricity 20 per cent. C.

FAIRFAX, MINN.—The village will take a vote on issuing bonds for $18,000 for the installation of an electric light plant.

ORLAND, CAL.—The voters of this place have voted in favor of levying a special tax to establish and maintain street lights.

LOS ANGELES, CAL.—Sealed bids are being received by the municipality for 10,000 sixteen-candlepower incandescent lamps.

SANDPOINT, IDAHO—Manager T. J. Humbird has announced that the company is to install a new plant at the Humbird mine at Kootenai. U.

INDEPENDENCE, CAL.—The Board of Supervisors will, on October 7, offer for sale a franchise for an electric-lighting system in this place.

BOISE, IDAHO—The Big Giant Gold Mining Company, of Boise, Idaho, has decided to equip its property with a modern, 300-ton milling plant. U.

HIGHLAND, CAL.—At a special election last week, the voters decided to organize as a lighting district under the law passed by the last Legislature.

TROPICO, CAL.—A new lighting district, to include part of this place, part of North Glendale and all of West Glendale, was organized here this week.

INDEX, WASH.—J. A. Soderberg, owner of the Index Granite Works, is installing an electric light plant which will supply light and power to Index and neighboring towns. C.

STAUNTON, VA.—The Beverly Garage Company has been incorporated here, having $25,000 capital, by M. W. Mercereau and associates, to conduct a garage business. L.

GRAHAM COUNTY, ARIZ.—J. Blackstein, of Clifton, has secured a three years' option on the Gold Belt property and will erect a twenty-ton reduction plant at the mine. U.

CHOTEAU, MONT.—The property of the Choteau Milling and Power Company was sold at sheriff's sale to Julius Hirshberg for $11,800. He will operate the mill and electric light plant. C.

SIGOURNEY, IOWA—J. F. Bray has purchased the plant of the Sigourney Electric Light and Power Company and will install a new plant with twice the power needed now. C.

TOLEDO, OHIO—The Consumers' Electric Company, of Forest, Ohio, has been incorporated, with a capital stock of $35,000, by E. B. King, A. K. Nier, C. B. Horn, M. S. Wilcox and A. C. Bowser. H.

IDAHO COUNTY, IDAHO—William L. Sendker, superintendent of the Penn-Dixie Mining Company, is authority for the statement that the company will erect a mill at the mine in the near future. U.

FRUITVALE, CAL.—At an election this week the voters of this place established a new lighting district. The new district will spend about $9,000 in the maintenance of electric lights during the coming year.

SALT LAKE, UTAH—The Portage Reservoir and Power Company has been incorporated here, with a capital stock of $10,000, by Charles W. Hall, Robert C. Harris, W. H. Gibbs, John Heaton, John F. Conley and others.

SEATTLE, WASH.—The Board of Public Works has contracted with the Forbes Electrical Supply Company for incandescent electric lights for the ensuing year. It is estimated that the contract will amount to about $40,000.

YREKA, CAL.—The Siskiyou Power and Electric Light Company has completed one-half of its electric power transmission line between its Fall Creek plant and Dunsmuir. The remainder of the line is to be completed in about two months.

CŒUR D'ALENE, IDAHO—The Carney Copper Mining Company, J. L. Martin, manager, operating in the Cœur d'Alene district, Idaho, has practically completed plans and specifications for the installation of a five to seven-drill water-driven compressor plant. U.

WASHBURN, WIS.—The city has entered into a contract with the Ashland Power Company, of Ashland, for furnishing electric power to the city from the White River dam. The line will be built at once and the power ready by November 1. A substation will be installed here. C.

OLEAN, N. Y.—The Olean Electric Light and Power Company has completed arrangements for the expenditure of between $40,000 and $50,000 for the doubling of the present capacity of its plant in this city. Every piece of machinery in the plant

is to be duplicated to be used in case of emergency. Two 200-horsepower gas engines are to be installed, with new generators, etc., for relay, which will insure the patrons uninterrupted service.

NASHVILLE, TENN.—The Etowah Electric Light and Power Company, McMinn County, has been incorporated; capital, $10,000; incorporators, P. A. Kinser, W. C. Reynolds, C. A. Graham, J. R. B. Rose, Dr. G. O. Bicknell.

PARK CITY, UTAH—The Daly-Judge Mining Company, of Park City, Utah, has decided to add to its compressor capacity. The company will utilize electric power, instead of steam, for the operation of its compressors. U.

LEWISTON, IDAHO—Articles of incorporation of the Northwestern Corporation of Walla Walla, with a capital stock of $5,000,000, have been filed. This is supposed to indicate extensive power development in this vicinity. U.

RENO, NEV.—Those members of the Reno Commercial Club who have been assisting John S. Loder in securing subscriptions to stock for the erection of a 400-ton smelter in this city, state that Reno is pretty sure to get the smelter. U.

DEMING, N. M.—The Northern Construction Company of Kansas City, Mo., has made an offer to the city to install an 800-horsepower electric power plant here under certain conditions, and their proposition has been favorably considered. U.

SWEETWATER, NEV.—The Walker River Electric Power Company, of which George B. Costigan and Dr. A. L. Pollard of Denver are heavy stockholders, will put in a $750,000 electric power plant on the East Walker River, near Sweetwater. U.

SAN FRANCISCO, CAL.—The directors of the Mojave Water and Power Company have voted to increase the bonded indebtedness of the company by $15,000,000. No plans for the expenditure of the money derived from the sale of the bonds have been made public.

NEWBERRY, S. C.—The Southern Power Company has completed the survey for transmission lines to this city and Whitmire, the lines to be about forty miles in length, tapping the main transmission lines from the power plant at Great Falls to Greenville, S. C. L.

HART, CAL.—Another big mill that will rival the Montgomery Shoshone of Ryholite is under advisement by a company of capitalists who have the funds to execute their plans. This is the Aurora Bullfrog Company, operating two miles north of Springdale, Nev., in the Pioneer district. U.

HICKORY, N. C.—Col. M. E. Thornton, largely interested in electric development in this section, is issuing a prospectus for "the largest cotton mill under one roof in the world," which he proposes to organize, the same to be operated by 6,000 electric horsepower, the company to have $4,000,000 capital. L.

RAMSEY, NEV.—A custom milling and reduction plant is to be built at Alamo canyon at the mouth of the working tunnel now being driven into the base of the Comstock Mountain, by the Wire Gold Mining and Milling Company. D. J. Kennedy and J. W. Halterman, Nevada mine owners, are interested. U.

OREGON CITY, ORE.—A big power plant, capable of furnishing light and power for factories, private enterprises, and the towns surrounding Oswego, is being projected by the Oregon Iron and Steel Company at Oswego. It is intended to install the plant at the lower end of Tualatin Lake, just above Oswego. U.

GRAHAM, N. C.—Stock is being subscribed for the launching of a new cotton mill to utilize the power that is to be developed from River Falls, below Saxapahaw. The power will be sufficient to drive a large plant, and J. W. Menefee, who owns the power site, is certain of the success of the cotton-mill project.

MACON, GA.—A number of land owners along the line of the Central Georgia Power Company transmission route have been served with legal notices, and condemnation proceedings will be ordered where necessary, thus insuring the speedy entrance of hydroelectric power into Macon. The power comes from Capps shoals and Lloyd shoals, W. Jordan Massee being president of the company. L.

TOLEDO, OHIO—A company to furnish light and power for Waterville, Ohio, was recently incorporated at Columbus. The concern has a capital stock of $10,000. The incorporators are Delmar J. Farnsworth, G. D. Dedrich, C. J. Stickney, H. F. Van Fleet, G. G. Schwind and J. M. Bennett, all of Waterville. The company plans the erection of a plant to supply light and power for the village and its industries. H.

JOPLIN, MO.—The Empire District Electric Company has been incorporated under the laws of Kansas, with an authorized capital of $6,000,000, to take over the properties of the Consolidated Light and Power and Ice Company, of Joplin, the Joplin Light, Power and Water Company, and the Galena Light and Power Company, and fifty-seven per cent of the stock of the Spring River Power Company of Missouri.

COLUMBIA, S. C.—P. L. Vogt, of the bureau of corporations of the Department of Commerce and Labor, was a recent visitor to this city, where he came to procure data, figures, etc., relative to the waterpower development in South Carolina, and the hydroelectric companies of the state. State officials gave all the information available at the capital. L.

SANTA BARBARA, CAL.—The Santa Barbara Gas and Electric Company has been incorporated here by C. H. Frink, W. R. H. Weldon, S. M. Kennedy, R. H. Ballard and Wm. Dieterle. The company has an authorized capital stock of $1,000,000. The new company will take over the properties of the Merchants' Mutual and Edison companies in this place.

PERU, IND.—The Peru Gas and Light Company has filed articles of incorporation with the secretary of state. The amount of the capital stock is $60,000. The corporation proposes to erect and equip a plant to furnish light, heat and power to the city of Peru and adjacent villages and communities by means of natural and artificial gas, electricity, steam and hot water, etc. George M. Dolby, Oscar Ridenour and Otto Sample, directors. S.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MAYFIELD, CAL.—The Peninsula Railroad Company has been awarded the electric-railway franchise in this city, which it recently applied for.

CLAREMONT, CAL.—The Ontario & San Antonio Heights Railway Company has secured a franchise for an electric street railway in this place.

COLUSA, CAL.—The Northern Electric Company has asked that its franchise in this place, which is about to expire, be extended for another year.

WEBSTER CITY, IOWA—It is stated that the Fort Dodge, Des Moines & Southern will buy the right-of-way of the Crooked Creek Railroad from Fort Dodge to Brushy. C.

EVANSVILLE, IND.—It is reported that the Evansville, Mt. Carmel and Olney Electric Railroad has been financed by Chicago bankers, and that work is to be begun on the construction in a short time. S.

SCOTTSBURG, IND.—Subsidy elections in aid of a tax for the construction of the Cincinnati, Madison & Western traction line will be held in three additional townships in Scott County, September 28. S.

STOCKTON, CAL.—The Central California Traction Company, operating city and suburban lines in and about this city, is preparing to build a seventeen-mile extension to Linden and Bellota in this county.

FRAZER, IOWA—The Fort Dodge, Des Moines & Southern Interurban Company is installing $20,000 worth of additional machinery in its power house, which, when completed, will be one of the finest plants in the United States. C.

SANTA ROSA, CAL.—J. E. Fulton, of the Sonoma County and Lake County Railroad Company, states that the company has secured rights-of-way for a standard-gauge electric railroad from Santa Rosa through Alexander Valley as far as Preston.

MENOMONEE FALLS, WIS.—The final move in assuring the building of the electric line through to Beaver Dam by the Milwaukee Electric Railway and Light Company was taken last week when application for the franchise was made to the town.

GARY, IND.—The officials of the Air Line Traction line started work with a vim on the construction of the Gary-Hammond line during the past week. Ties are on the ground and rails are arriving and will be laid as rapidly as the roadbed can be constructed. S.

BLUFFTON, IND.—Arrangements have been made for switch connection between the Muncie, Bluffton and Eastern Traction Company and the Cloverleaf steam line in this city. When completed the traction line will be able to send through freight over the steam line. S.

GEORGETOWN, S. C.—It is reported that the proposed electric-railway system here has materialized, that rolling stock and equipment has been purchased, the local electric-lighting plant capacity increased to meet the larger power demand, and that the tracks will be laid soon. L.

MACON, GA.—It is stated that the building of the Atlanta-Macon trolley will be completed within one year. The merger of the building company with other electric interests and the floating of bonds, backed by the four merged concerns, has been under negotiation for some time. L.

SAVANNAH, GA.—Savannah is to have a new traction company and over $500,000 is expected to be expended upon the plant and equipment. Plans have already been prepared for much of the improvements, and modern electric equipment is already being added to the present plant by the Savannah Lighting Company. The company will be a competitor of the Savannah Electric Com-

pany, which is owned by the Stone & Webster interests of Boston. It is understood that the plans considered embrace the laying of over thirty or forty miles of track service to Tybee, Isle of Hope, Montgomery and possibly other sections of the county.

COLUMBIA CITY, IND.—The City Council is asking for bids for the complete rebuilding of the municipal electric-light plant, including the furnishing and installation of three vertical boilers of 200-horsepower capacity, generators and other necessary equipment. E. R. Vincent is the city engineer. S.

SAN FRANCISCO, CAL.—It is reported from Los Angeles that J. M. Neeland, of Redlands, G. A. Atwood and M. N. Newmark, of Los Angeles, and others are preparing to build an electric railroad from Redlands to the townsite of Yucaipa City, a distance of nine miles, with a branch to Oak Glen.

WARSAW, IND.—The Winona Traction Company has been reorganized and H. J. Heinz, of Pittsburg, elected president. The road will now be operated independent of the Winona Assembly, and the work of completing the Warsaw-Peru branch rushed along and the division put in operation before winter. S.

RALEIGH, N. C.—The recent "electric headlight act" of the state Legislature, after being vigorously fought before the corporation commission, has been declared legal and will become effective, twenty-five per cent of all engines to be equipped annually, beginning April, 1910, until all engines are so equipped. L.

FT. WAYNE, IND.—The beginning of the construction work on the new Ft. Wayne and Bryan Traction line was started near this city last week. The event was made the occasion of a celebration largely attended by citizens interested in the line. The first shovelful of dirt was thrown by R. T. Bastress, president of the company. S.

KALAMAZOO, MICH.—A mortgage for $3,000,000 has been given by the Michigan & Chicago Westbound Transportation Company to the Chicago Title & Trust Company, and covers interurban property. The filing of this mortgage assures electric railroad connection between Kalamazoo and Grand Rapids. The mortgage provides that loans are not to exceed $25,000 a mile of railroad.

KINGMAN, IND.—Superintendent Peoples, of the Covington and Northwestern Traction Company, announces that the construction of the line from Kingman to Wallace is almost ready for operation. The power house is completed and all the machinery in place, except the generator and switchboard. The stringing of the trolley wire will be completed in about two weeks. S.

OTTAWA, ILL.—The Chicago, Ottawa & Peoria Railway Company is making dirt fly between Grand Ridge and Ottawa, building the line that will connect Ottawa with Streator. The men having the contract for the grading are pushing the work as rapidly as possible, and arrangements are now being made for carrying the electric power from La Salle to the Grand Ridge substation.

HARTFORD, CONN.—It is announced that on September 1 the Farmington Street Railway Company was taken over by the Connecticut company, the trolley-operating company of the New York, New Haven & Hartford Railroad. The authorized capital stock is $189,000, of which $157,000 is outstanding. The bonded debt of the company is $30,000 and the floating debt $35,905.86. The president is E. D. Robbins.

TOLEDO, OHIO—The Toledo Railways and Light Company handled more than a million people during Wamba Week. Saturday night the congestion surpassed all records because of masked Calathumpian privileges. During the first half of the night the company operated 250 cars, only owl cars being operated the last half of the night. The receipts were a trifle under those of Grand Army Encampment week last year. H.

POTTSVILLE, PA.—Surveys are to be made for a new trolley line from Pottsville, through St. Clair, Morea and Delano to Shenandoah, to connect with the Schuylkill Traction System. The new link will connect with the system of the Eastern Pennsylvania Railways Company. The route approximates fifteen miles, and will complete a chain of 100 miles of trolley road in Schuylkill through Carbon County to Mauch Chunk.

OKLAHOMA CITY, OKLA.—The Oklahoma City & Suburban Railway Company has incorporated here for $250,000. The new company will construct four interurban lines, according to the charter, the main line to extend from Britton to Edmond and Oklahoma City to Moore, thirty-two miles in length. The incorporators are Charles W. Ford, superintendent of the Oklahoma Railway Company, and J. J. Johnson, secretary. U.

BRIDGEPORT, CONN.—The Connecticut Company has placed a contract for twenty double-truck closed trolley cars for use on the lines in the Bridgeport district. The order calls for the expenditure of about $130,000 and the cars are to be ready for delivery by December 1. The work on the car barns and repair shops which the Connecticut Company is erecting at Bridgeport at an expense of over $250,000 is steadily progressing.

PIERRE, S. D.—Articles of incorporation have been filed with the secretary of state for the Missouri River & Northern Railway Company, with headquarters at Gann Valley, and a capital of $1,000,000. The proposed line is to be 100 miles in length, and in the counties of Charles Mix, Brule, Buffalo, Hand and Faulk. The incorporators are: W. O. Crockett, J. B. Ingersoll, J. E. Zelbach, Gann Valley; J. Q. Anderson, Chamberlain; J. B. Ross, Miller.

AUSTIN, TEX.—The charter of the San Angelo Street Railway Company, having a capital stock of $100,000, has been filed. The company is composed of citizens of San Angelo, who have taken over the property of the street railway company, which has been in the hands of a federal receiver. Also, the Port Arthur Traction Company, with a capital stock of $200,000, has filed articles of incorporation. The company is composed principally of Ohioans.

INDIANAPOLIS, IND.—The South Bend and Logansport Traction Company, capitalized at $400,000, has filed articles of incorporation with the secretary of state. The company proposes to build a traction line from South Bend to Logansport by way of Rochester, Plymouth and other intervening towns. The incorporators are: Thos. P. Moredock, Virginius Nicar, Patrick J. Houlihan, South Bend; Henry Coleman, Logansport, and David Pepper of Philadelphia. S.

BARTLETT, TEX.—Construction work will soon begin on the railway between Bartlett and Florence, a distance of twenty miles. The contract has been let by the Bartlett-Florence Railway Company, of which G. W. Hubbard is president and W. J. McDaniel first vice-president and general manager. The line will be operated by steam at first, but will be changed into an electric traction line as soon as practicable. The road passes through a rich agricultural country. D.

TOLEDO, OHIO—Eli West, of Columbus, and George Whysall, of Marion, were this week appointed receivers for the Columbus, Marion & Bucyrus Electric Railroad. The appointment was made by Judge Daniel Babst, of the Marion Common Pleas Court upon the application of the Cincinnati Trust Company and the Webb Construction Company. The petition recites that the company has bonded indebtedness of $500,000, on which accrued interest of $12,500 is unpaid, and in addition that it owes to the trust company $7,500 borrowed money. The road was built from Marion to Bucyrus two years ago and has been operated by the Webb Construction Company, never having been turned over to the holding company. H.

BALTIMORE, MD.—Articles of incorporation for a company to operate a trolley line on the Eastern Shore, with connection by ferry with Baltimore, have been filed at Chestertown, Kent County, and subscriptions to the stock of the concern are likely to be invited. The present plan of the promoters is to offer the stock to the public, in the belief that small investors will welcome the opportunity of backing the enterprise. The company will be called the Baltimore and Eastern Railway Company. On conservative estimates the promoters believe that the road can be completely equipped at a cost of $2,500,000 to $3,000,000, this to include rolling stock, power houses and all the requisites of a first-class road. The road will pass through Kent, Queen Anne's and Talbot counties, and it is also proposed to maintain a fast steamer ferry service between Rock Hall and Bay Shore, which will be a valuable addition to the main line. The organization of the new company is the first practical step toward a connecting link of rapid transit between Baltimore and the Eastern Shore, and the means of bringing that rich territory in direct communication and quick access of the markets of this and other nearby cities.

PEORIA, ILL.—A party of newspaper men of the local papers were guests of the Illinois Traction System last week, going to St. Louis via the electric line, and examined the new bridge that the company is building across the Mississippi at that city. The construction has reached the river, the approaches being finished; the piers that are in the river are also all built, and the work of building up the steelwork will commence soon. To enter the city the company just purchased twenty acres of ground that it will use for storage tracks and switching yards. The route goes clear uptown to the point at East Gay and Lucas streets, where the company will erect an immense freight house, with a loop up Gay Street to Fourteenth Street and down Lucas Street to Twelfth Street. The bridge will be completed early in the year and with the finishing of the bridge passenger service will be at once commenced. This is the greatest improvement the company has planned, as it gives it southern terminals in St. Louis, whereas they now end at Granite City. Through cars will be placed on all the lines, with sleeping-car service at night. With the completion of the bridge across the Mississippi the Illinois Traction Company will begin a system of electric interurban lines in Missouri, leading from St. Louis, a direct line to Kansas City. At least, this is the announcement of Congressman W. B. McKinley, head of the interurban system. V.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

LADYSMITH, WIS.—A franchise has been awarded to the Rusk County Rural Telephone Company.

JANESVILLE, MINN.—The Cannon Valley Telephone Company is to make extensive improvements in its equipment.

KERKHOVEN, MINN.—The Kerkhoven Telephone Exchange Company has been incorporated with a capital stock of $10,000.

DEERWOOD, MINN.—Work has been started on an exchange building for the Deerwood & Bay Lake Telephone Company.

VALPARAISO, IND.—The Northwestern Indiana Telephone Company has notified the secretary of state that the company had increased its capital stock from $50.000 to $100,000. The purpose is to make extensions and improvements in the telephone system. J. H. McGill, president, and L. R. Skinner, secretary. S.

WATERBURY, CONN.—A new telegraph line is soon to be built by the Western Union between this city and Hawleyville, a distance of twenty-four miles. The new line is necessitated to facilitate communication between the central division railroad offices at the new station in this city and the Berkshire division. The new telegraph line will be used for railroad business only and is about all that remains to be finished before the transfer of the western division offices from New Haven to this city.

FORT COLLINS, COLO.—Construction began last week on an extension of the government telephone line on the Medicine Bow forest, from the Rustic hotel on the Poudre River to Glendevy on the Laramie River. Co-operation between the forest service and the Laramie Poudre Reservoir and Irrigation Company made the building of the line possible. It will be twenty-eight miles long and will give the government 110 miles of telephones on the Medicine Bow forest. It will bring the settlers on the upper Laramie River into communication with Fort Collins by way of the Estes park exchange of the Colorado Telephone Company.

LUCAS, KAN.—A new telephone company has been organized in this city with a view to purchasing the present system and improving it. The company is composed of merchants and farmers of this county, and is capitalized at $12,000. The company elected officers as follows: President, F. A. Vopat; treasurer, C. M. Lansbury; secretary, J. H. Moore; directors A. G. T. Cooper, B. G. Servian, F. A. Vopat, Charles Lansbury and F. W. Barr. The company has obtained a charter and took possession of the business on September 1. All the country lines in this county will be put in first-class condition as well as the lines in the city.

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

LOS ANGELES, CAL.—The General Special Electrical Company has been incorporated here, with a capital stock of $100,000, by O. A. Hansen and F. T. Broiles.

SAN FRANCISCO, CAL.—The Sierra Pacific Electric Company has been incorporated here, with a capital stock of $5,000, by C. P. Eells, Hugh Goodfellow, J. S. Eells.

FAYETTEVILLE, N. C.—The Electric Cleaning Company has been incorporated at this place by F. H. Bradley and associates, with a capital of $25,000, to operate electrically-driven renovating machines, etc. L.

LONG BEACH, CAL.—The Long Beach Electrical Manufacturing Company has been incorporated here, with a capital stock of $20,000, by T. J. Corbrey, W. H. Tidmarsh, S. F. Estell, J. Gleason and C. Gleason.

PERTH AMBOY, N. J.—The Modern Art Lamp Works has been incorporated, with a capital of $50,000, to manufacture gas and electric fixtures. The incorporators are: A. Scheadow, S. Spitzer and H. Ellis, of Perth Amboy.

NEW YORK, N. Y.—The Automatic Electric Igniter Company has been incorporated to manufacture gas and electric light fixtures. The capital is $40,000, and the incorporators are N. Candelora, E. De Feo and V. Blasio, New York city.

BINGHAMTON, N. Y.—The Diamond Electric Company has been incorporated to manufacture electrical devices and appliances, with a capital of $100,000. The incorporators are: S. J. Hirschmann, J. Schwab and H. C. Price, Binghamton.

NEW YORK, N. Y.—The Manhattan Railway Supply Company has been incorporated with a capital of $110,000 to manufacture and deal in railway supplies. The incorporators are: A. J. Hammerslough, A. L. Strasser and L. M. Wallstein, New York city.

SARANAC LAKE, MICH.—The Flint Sanitary Mouth Piece Manufacturing Company has been incorporated to manufacture telephone, telegraph, musical and surgical instruments; capital, $25,000. Incorporators: B. B. Flint, G. A. Rutherford, A. K. Botsford, Saranac Lake.

ELECTRICAL SECURITIES.

It is always the unexpected that happens, and while the stock market has been agitated over the question of the late Edward H. Harriman's health, he quietly died. Stocks did not decline. On the contrary, the best known Harriman securities advanced very sharply. That wise perspicuity which ever characterized the man stood in the breach; and even after death he remained a tower of strength.

In the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 4, there appeared a short item with the caption, "Harriman Has Crossed the Rubicon." He has indeed crossed it and in a way not expected, but as far as electrical securities are concerned he gave the living world his opinion of what the future he left behind must be. He, first of all the great railway men of the country, saw the handwriting on the wall, and it will be afterwards found one of his greatest monuments that his railways in California were the first practically in the whole United States to be electrified in a comprehensive, systematic and far-reaching manner.

The ups and downs of the market may come and go. But there is a solid basis of extraordinary prosperity behind it all, clearly expressed in the late railway chief's own words, "I come back to my country, and I see no reason to alter the opinion expressed when I left, that it will grow and grow and prosper—and the future is bright."

The dying man has left his seal mark on electrical securities that are legitimate and based on conservative business principles. What better recommendation?

The following have been added to the regular list of the Philadelphia Stock Exchange: $765,000 additional capital stock of the American Telephone and Telegraph Company, issued in exchange for $1,025,000 four per cent convertible bonds, making the total amount of stock listed at this date $241.896,300 and reducing the amount of said bonds outstanding to $67,665,000.

The August passenger receipts of the Philadelphia Rapid Transit Company increased about $91,000 over August, 1908, following an increase in July of $139,767, so that in the first two months of the current fiscal year the gross earnings gained $231,000 over the corresponding period of the previous year.

For seven months ending with July the Northern Ohio Traction Company shows gross earnings of $1.200,953; net, $531,937; interest, $306,710; surplus for stock, $325,226.

The Michigan State Telephone Company, the securities of which are owned largely in Chicago, reports for the first seven months of this year a gross revenue of $2,162,115, which is an increase of $223,420 over the gross in the corresponding period last year. The surplus earnings, after the payment of all operating and interest charges and dividends on the stocks, were $175,168. The company expended out of its surplus earnings $816,306 between February, 1904, and the first of the present month. The net gain in new stations in the first seven months this year was 10,385.

DIVIDENDS.

The Canadian General Electric Company has declared the regular quarterly dividend of three-fourths per cent on its preferred stock.

The General Chemical Company has declared the regular quarterly dividend of one-and-one-half per cent on its preferred stock, payable October 1 to stockholders of record September 20.

Carolina Power and Light Company; regular quarterly dividend of one-and-one-half per cent on the preferred stock of the company, payable October 1 to stock of record August 31.

Cincinnati & Suburban Bell Telephone Company; regular quarterly dividend of two per cent payable October 1.

Columbus Railway and Light Company; quarterly dividend of three-quarters of one per cent, payable October 1 to stock of record September 15. This is an increase of one-fourth of one per cent over the dividend three months ago.

Duluth Superior Traction Company; an initial dividend of one per cent on the common stock, payable on and after October 1 to stockholders of record September 15.

Louisville Traction Company; regular quarterly dividend of one per cent on the common stock, payable October 1.

Manila Electric Railway and Lighting Corporation; regular quarterly dividend of one per cent on the common stock, payable October 1 to stock of record September 20.

Manhattan Railways Company; regular quarterly dividend of one-and-three-fourths per cent, payable October 1 to stock of record September 15.

San Diego Consolidated Gas and Electric Company; quarterly dividend of one-and-one-fourth per cent, upon the common stock, payable September 15 to stockholders of record as of the close of business September 15.

St. Joseph Railway Light, Heat and Power Company; regu-

lar quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable October 1 to stock of record September 15.

Twin City Rapid Transit Company; regular quarterly dividend of one-and-three-fourths per cent on the preferred stock, payable October 1 to stock of record September 15.

Union Traction Company of Indiana; regular semiannual dividend of two-and-one-half per cent on the preferred stock, payable October 1 to stock of record September 25.

United Gas Improvement Company; regular quarterly dividend of two per cent, payable October 15 to stock of record September 30.

United Traction and Electric Company; regular quarterly dividend of one-and-one-fourth per cent on the stock of the company, payable October 1.

West End Street Railway; semiannual dividend of $1.75 per share on the common stock October 1.

West Jersey & Seashore Railroad; semiannual dividend of two-and-one-half per cent, an increase of one-half of one per cent over the similar period in 1908, and making four-and-one-half per cent paid on the stock in 1909. The dividend is payable October 1 to stock of record September 15.

Western Union Telegraph Company; regular quarterly dividend of three-fourths of one per cent, payable October 15 to stock of record September 20.

NEW YORK.

	Sept. 13.	Sept. 6.
Allis-Chalmers common	14⅞	15⅜
Allis-Chalmers preferred	51½	52½
Amalgamated Copper	78⅛	84
American Tel. & Cable	*80	*80
American Tel. & Tel.	140¼	141¾
Brooklyn Rapid Transit	77	78⅞
General Electric	165	166
Interborough-Metropolitan common	14	14¼
Interborough-Metropolitan preferred	45½	46½
Kings County Electric	130	130
Mackay Companies (Postal Telegraph and Cables) common	81	82½
Mackay Companies (Postal Telegraph and Cables) preferred	73¾	74½
Manhattan Elevated	142	141
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	137	138
U. S. Steel common	79	80
U. S. Steel preferred	125½	127¼
Western Union	76	75⅜
Westinghouse common	84½	85½
Westinghouse preferred	130	130

*Last price quoted.

BOSTON.

	Sept. 13.	Sept. 6.
American Tel. & Tel.	140¼	141¾
Edison Elec. Illuminating	254	256
General Electric	165	166
Massachusetts Electric common	16	17
Massachusetts Electric preferred	77	78
New England Telephone	134	136½
Western Tel. & Tel. common	10	11½
Western Tel. & Tel. preferred	88	90

PHILADELPHIA.

	Sept. 13.	Sept. 6.
American Railways	46	46
Electric Company of America	12	12¼
Electric Storage Battery common	62½	63
Electric Storage Battery preferred	62½	63
Philadelphia Electric	12⅜	12⅝
Philadelphia Rapid Transit	29⅞	30
Philadelphia Traction	91	90¾
Union Traction	53½	53

CHICAGO.

	Sept. 13.	Sept. 6.
Chicago Railways, Series 1	110	110
Chicago Railways, Series 2	36¾	37¼
Chicago Subway	16	17¾
Chicago Telephone	130	135
Commonwealth Edison	120	120
Metropolitan Elevated common	15¼	15⅛
Metropolitan Elevated preferred	48½	49
National Carbon common	95	95
National Carbon preferred	119	119

PERSONAL MENTION.

E. G. CONNETTE, recently appointed transportation engineer of the New York Public Service Commission, has begun his duties in that position.

R. R. KELLY, M. Can. Soc. C. E., and formerly city engineer of Edmonton, Alberta, has been appointed professor of electric engineering in the Nova Scotia Technical College, Halifax, N. S.

E. L. CLARK, president of the Valentine-Clark Company, Chicago, and president of the Northwestern Cedarmen's Association, has practically recovered from the painful accident with which he met several months ago. Mr. Clark is again at his office and ready to resume his duties. His friends unite in congratulating him on his recovery.

JOHN B. PARSONS, president of the Philadelphia Rapid Transit Company, retired from that position on September 15. Announcement of the retirement was made after a meeting of the Board of Directors on September 9. The Board created a new office, Chairman of the Board of Directors, to which Mr. Parsons was elected. No successor as president was named.

OBITUARY.

E. H. HARRIMAN, capitalist, railroad man and financial genius, died on Thursday, September 9. Mr. Harriman, at the time of his death, was easily the leading railroad man in America, and it is doubtful if he had any peers in this connection in the world. Edward Henry Harriman was born at Hempstead, Long Island, New York, on February 25, 1848, the son of the Reverend Orlando H. Harriman. He received a common school education and became a broker's clerk in Wall Street at the age of fourteen. Later on he became a broker for himself, and so unassuming was his nature that he was a potent influence in the membership of the New York and other Stock Exchanges for many years before his affiliation with these bodies was a matter of note. Mr. Harriman's career has been almost unparalleled, and his rise to the mastery of some 65,000 miles of transcontinental railroad, to the presidency of a score of important railway and financial institutions, and his participation in the directorate of a score more of enterprises of a similar nature made him a conspicuous figure in the world of commerce and finance. He was deeply interested in electrification, and it may be said that his properties were among the first to take on in a systematic and practical way the benefits of this modern use of power, and he was on the directorate of a number of large electrical public service corporations. In fact, his endorsement and acceptance of electrical securities gave to these a stability which might otherwise have been lacking for some time. Despite his wonderful business career and the demands which his interest in so many commercial directions must have demanded, Mr. Harriman created for himself a remarkable portion of esteem in the minds and hearts of all who came in close contact with him. There is a wealth of information concerning his active and practical philanthropy and his great interest in the welfare of his brother man. Personally he was genial and cordial and devoted not a little time to recreation and the finer qualities of sportsmanship. He was well beloved by those who knew him, particularly by those who had the management of his immediate personal affairs. Recently Mr. Harriman built a beautiful country seat at Arden, N. Y., which, however, he did not live to enjoy. He was brought there a very sick man, and the mechanics had to suspend work during the last illness of their employer. He was buried at Arden, on September 12.

PROPOSALS.

POST OFFICE, DENISON, TEX.—The Supervising Architect, Washington, D. C., will receive sealed proposals until Oct. 1 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Denison, Tex., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Denison, Tex., or at the supervising architect's office.

POST OFFICE, ELGIN, ILL.—The Supervising Architect will receive sealed proposals until October 19 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Elgin, Ill., in accordance with drawings and specification, copies of which may be obtained from the custodian at Elgin, Ill., or at the discretion of the Supervising Architect.

POST OFFICE, LANCASTER, OHIO—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 6 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Lancaster, Ohio, in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Lancaster, Ohio, or at the supervising architect's office.

POST OFFICE, FREDERICKSBURG, VA.—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 4 for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Fredericksburg, Va., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Fredericksburg, Va., or at the supervising architect's office.

POST OFFICE, JACKSON, MICH.—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 7 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the U. S. Post Office, Jackson, Mich., in accordance with the drawings and specifications, copies of which may be obtained from the custodian of site at Jackson, Mich., or at the supervising architect's office.

POST OFFICE, GREAT FALLS, MONT.—The Supervising Architect, Washington, D. C., will receive sealed proposals until September 29, for the construction (including plumbing, gas piping, heating and ventilating apparatus, electric conduits and wiring, and standard clock system) of the U. S. Post Office and Court House at Great Falls, Mont., in accordance with the drawings and specifications, copies of which may be had from the custodian of site at Great Falls, Mont., or at the supervising architect's office.

POST OFFICE, MANITOWOC, WIS.—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 20 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Manitowoc, Wis., in accordance with drawings and specification, copies of which may be had from the custodian of site at Manitowoc, Wis., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, BELFAST, ME.—The Supervising Architect, Washington, D. C., will receive sealed proposals until Oct. 14 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the U. S. Post Office and Custom House, Belfast, Me., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Belfast, Me., or at the supervising architect's office.

NEW PUBLICATIONS.

POLYTECHNIC INSTITUTE OF BROOKLYN—A prospectus has recently been issued by the Brooklyn Polytechnic Institute relating to a series of evening technical courses of that institution.

WORCESTER, MASSACHUSETTS, THE IDEAL INDUSTRIAL CITY.—This is the title of a heart-shaped booklet which is being distributed by the Chicago Association of Commerce. The booklet was got up and published in connection with the excursion from Worcester and neighboring towns to the Pacific Coast and to the Alaska-Yukon-Pacific Exposition at Seattle, under the auspices of the Worcester Board of Trade. In the words of the introduction, "this booklet is designed to epitomize the civic and industrial growth of Worcester from its founding, and to serve as a souvenir for distribution among the members of commercial organizations, in various western cities, who have so generously offered us their hospitality during our brief stays with them."

NATIONAL ELECTRIC LAMP ASSOCIATION BULLETINS—Two new bulletins have just been issued by the Engineering Department of the National Electric Lamp Association. Bulletin 9, entitled "Conservation of Our Natural Resources Through the Use of High-Efficiency Lamps," is extremely readable and treats of a subject of timely interest. It discusses in detail the placing of the central-station rates and charges on a logical basis, which will allow of a more extensive use of high-efficiency lamps than has heretofore been possible. Bulletin 8A, entitled "Tungsten Miniature and Low-Voltage Lamps," describes and illustrates with cuts and tables, lamps for automobile service, general battery service, novelty battery service and dental, optical or surgical battery service. In a separate section, this bulletin deals with large (i. e., not miniature) tungsten lamps for voltages from four to twenty. There should be a large field of usefulness for these low-voltage lamps in candlepowers ranging from four to twenty-four for certain special classes of service, such as isolated lighting installations supplied from storage batteries, decorative lighting, fire-exit marking, and for all cases which require lamps of lower candlepower than can be obtained with metallic filaments in the higher voltages.

INDUSTRIAL ITEMS.

THE COLUMBIA INCANDESCENT LAMP COMPANY, ST. LOUIS, MO., is distributing post-cards describing the Columbia tungsten lamps.

THE OSHKOSH LOGGING TOOL COMPANY, OSHKOSH, WIS., is distributing a catalogue describing its line of construction and linemen's tools.

THE McROY CLAY WORKS, Brazil, Ind., is distributing a blotter containing a calendar for the current month, also a pleasing poem entitled "Fishing."

THE NEW YORK INSULATED WIRE COMPANY, NEW YORK, N. Y., is distributing two advertising blotters containing descriptions of its wire and tape.

THE SCIPLE SECTIONAL POLE COMPANY, Minneapolis, Minn., has recently published a booklet describing and illustrating its various types of sectional steel poles.

J. W. CARTER AND COMPANY, Abilene, Tex., have recently appointed the Canadian General Electric Company of Toronto, Ont., their agent to handle the Eclipse adjuster throughout Canada.

THE THORDARSON ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has issued "Thorardson's Electrical Specialties," for distribution to the trade, describing the various kinds of ignition coils, large and small capacity transformers, laboratory equipment, etc., manufactured by the company.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued the August number of its popular magazinette, "Trumbull Cheer," which, besides the usual miscellaneous assortment of light literature, contains particulars of switches, flush receptacles, etc., made by the company. An enclosed leaflet invites every one of the 7,500 concerns already on the company's list to send in the names of its customers and other persons interested, so that they may be sent "Trumbull Cheer" as it comes out each month. It is worth having.

THE R. WILLIAMSON COMPANY, CHICAGO, ILL., announces that it will erect an addition to the present building to accommodate the increased demand for its fixtures.

THE PHILADELPHIA STORAGE BATTERY COMPANY, PHILADELPHIA, PA., is sending out postal cards announcing the removal of its offices from the present site to the new factory building, Ontario and C streets, Philadelphia, Pa.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., reports taking a number of orders for electrical apparatus recently, among which are a slow-speed engine-type 150-kilowatt generator, seventeen motors of various sizes for ventilating work, and a 250-kilowatt engine-type generator for export.

THE GREEN FUEL ECONOMIZER COMPANY, MATTEAWAN, N. Y., has recently issued bulletin No. 126, devoted to drying in industrial plants. It contains a description of drying equipments as used in various industries, also a brief discussion on the theory of drying. Copies of this bulletin may be had on request.

THE EXCELLO ARC LAMP COMPANY, New York, N. Y., has issued an amusing little chart entitled "The Philosophy of Life," which shows the disconcerting contradictions of which this life is made. At the end is a facetious remark to the effect that by means of an Excello flaming arc one will look at things in a different light.

THE MOORE ELECTRICAL COMPANY, Newark, N. J., has received an order for three installations of the Moore Light in Berlin, Germany. The necessary apparatus has been forwarded and James A. Holt, who will have charge of the work, sailed for Bremen, on August 5, on the North German Lloyd steamship, "George Washington."

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., has entered the field as manufacturer of machinery for sand lime brick and has employed as commercial engineer Franklin Henshaw, an engineer of wide experience in this line and formerly associated with the International Sand-Lime Brick Company of New York city.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., announces that it is now in a position to furnish Sunbeam tungsten lamps in voltages between 200 and 250. The lamps are made in four sizes at present, namely, forty-five, seventy, 112 and 180 watts. Information and prices may be obtained from the nearest branch house of the company.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has recently published a number of bulletins which indicate a radical departure from the usual argument of such publications. A bulletin on the subject of alternating-current generators is typical. It contains much valuable information regarding alternating-current generators and synchronous motors.

THE ELECTRICAL CONSTRUCTION SUPPLY COMPANY, Springfield, Ohio, has ready for distribution some interesting literature and price-lists devoted to malleable iron brackets, pins and break arms for electric-light and telephone companies, and automatic suspension pulleys. This company is the owner and manufacturer of these devices, made under the Chubbuck patents.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., has issued a folder with a striking red cover, extolling the merits of sherardized National Metal Molding and showing particularly its advantages and lasting qualities, as compared with wood molding. Enclosed in the folder is a postcard for use in reply for further particulars and for requesting a sample of the molding.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, MINNEAPOLIS, MINN., announces that it has recently taken the agency for the west, for the roofing and siding manufactured by the Asbestos Protected Metal Company, Canton, Mass. This material is particularly adapted for use on gas houses, chemical works, etc., being immune to the attack of acid fumes, gases and moisture by reason of its peculiar construction. The above announcement appears in a recent publication of the Asbestos Protected Metal Company.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has devoted sections G4a and G5 of its new perpetual catalogue to showing various mountings of its enameled resistance units for telephone and telegraph, signal service, etc. The units are arranged for mounting in Edison base lamp sockets, or in fuse clips, and many other new methods of mounting are shown. The enameled resistance unit consists of a bare wire wound upon a porcelain tube covered with enamel, thereby protecting the wire from electrical, mechanical and chemical depreciation.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY reports that its business for August reached an amount equal to that of the preceding month, July, which showed

a record of $3,000,000 and represented the largest orders in two years. The recent order of the Chicago Railways Company for 1,400 street-railway motors has just been swelled by an additional order for 200 of the same type. The Pittsburg Railways Company has also placed an order for 240 motors of 100 horsepower, in addition to other railway machinery. The Maryland Electric Railway Company will extend its single-phase equipment at Baltimore, and has also entered an order for additional motive-power apparatus.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued the following recent publications: Bulletin 4664 describes a new line of improved direct-connected, engine-driven railway generators, Form S. These generators range in capacity from 100 to 2,700 kilowatts, and the speeds have been carefully selected to adapt the generators for direct-connection to steam engines. They are designed to run at constant speed, and for the prevailing full-load railway voltages. The bulletin illustrates the generator and important parts, and gives a table of general dimensions. Bulletin 4666 describes an improved form of the well-known Type H transformer, of which there are more than 50,000 in use at the present time. The advantages claimed for the new design are: Better efficiencies, greater uniformity of impedances, an improved connection board, together with an improved method of supporting the primary and secondary leads, and a new type of suspension hook, as well as a new device for clamping the transformers in the cases. The bulletin contains numerous illustrations of the transformer, and shows the methods used in the different processes of manufacture. Tables showing the frequency limits, and a curve indicating the reduction in the core and total losses of the improved Type H transformer over previous designs, are also shown. Bulletin 4668 describes the G. E. 216-A railway motor, which is of the box-frame type, with commutating poles, mica-insulated brush-holders, and removable armature shaft. Among the advantages claimed for this type of construction, in addition to the substantial mechanical features, are: Practically sparkless commutation on even heavy overloads, reduced wear on commutator, together with a marked reduction in commutator heating, increased life for the brushes and increased efficiency and free-running capacity. The motors are of fifty-horsepower capacity, designed for operation on 600-volt railway circuits. The bulletin contains lists of gear ratios, and shows characteristic curves as well as dimension diagrams. There is also a carefully prepared table of schedule speeds and a comprehensive data sheet for those desiring quotations. Bulletin 4670 describes gaskets and bell mouths for conduit wiring, underground circuits, etc. The illustrations in the bulletin include dimension diagrams of the soft-rubber gaskets and metallic bell mouths, and a complete set of tables enables the customer to determine the size of bell mouths required for any particular service, and to ascertain readily the proper gasket which should be used.

DATES AHEAD.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 31, 1909.

933,084. TROLLEY. Joseph Ledwinka, Philadelphia, Pa. Filed November 11, 1905. Renewed October 8, 1908. Two parallel frames, connected to a cross-arm but insulated from one another, carry each a pair of axially-movable spring-controlled trolley wheels arranged in tandem.

933,094. ART OF TREATING GASES ELECTRICALLY. Ignacy Moscicki, Gambach, near Fribourg, Switzerland. Filed August 6, 1907. The arc between electrodes of an electric furnace is magnetically moved; one electrode is transverse to the movement of the gas, and the other is provided with passages through which the gas may flow.

933,095. ACCURATE-AIM FLASH-SIGHT. Dosier H. Mosteller, Chicago, Ill., assignor to the Mosteller Manufacturing Company, Chicago, Ill. Filed April 13, 1909. The shadow of the bead from light rays of an electric lamp shows where the bullet will strike.

933,115. COMBINATION SPARK GAP AND PLUG. Arthur L. Ryder, Pasadena, Cal. Filed May 15, 1907. The plug is hollow and is devised so that the spark gap may be seen through a transparent wall.

933,132. ELECTRIC-LIGHT FIXTURE. Theodore Smith, Chicago, Ill., assignor to Theo. Smith Manufacturing Company, Chicago, Ill. Filed October 3, 1904. Has a curved composite adjustable standard.

933,133. PROCESS OF TREATING ZINC ORES. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. Filed June 23, 1905. The ore is smelted with carbon on a slag bath (in contact with an electrode) which is floated on a molten lead electrode in an air-free electric furnace so that the zinc is volatilized and the molten lead sinks through the slag.

933,137. ELECTRIC FLASHER. Daniel D. Swem, Chicago, Ill. Filed June 27, 1908. Describes the details and action of an electric flasher.

933,149. TELEPHONE TRUNKING SYSTEM. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed September 21, 1904. Gives the connections of a trunk circuit and a cord circuit associated with a branch connection.

933,150. TELEPHONE SYSTEM. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed November 29, 1907. Describes a telephone system in detail.

933,157. ELECTRIC CONTROLLER. Tracy V. Buckwalter, Altoona, Pa. Filed January 20, 1909. A reciprocating part of insulating material has fixed to it brushes which are electrically connected respectively to a pair of carbons.

933,169. ELECTRIC TRANSFORMER-FURNACE. Otto Frick, Saltsjöbaden, Sweden, assignor to The Gröndal Kjellin Company, Limited, London, England. Filed September 14, 1906. Renewed March 20, 1908. Windings on a conductor are arranged in inductive relation to the leakage field and main field of the furnace so that the combined inductive effect upon the conductor due to these fields will be zero.

933,195. ELECTROLIER. James McGavin, Springfield, Ill. Filed September 9, 1908. The lamp (or lamps) is (or are) connected to a winding mechanism.

933,197. SIGNALING SYSTEM. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill. Filed May 4, 1903. The transmitting mechanism includes a normally wound-up, electromagnetically-controlled, clockwork, switch-operating device, the electromagnetic controller being in series with the line circuit and a make-and-break device, and a shunt includes a signal-initiating device, etc.

933,208. TROLLEY-POLE. Samuel Speer, Pittsburg, Pa. Filed March 29, 1909. The trolley-pole proper consists of two telescoping sections which can be adjusted longitudinally against the action of a spring by means of a parallelogram device.

933,211. SYSTEM OF DISTRIBUTION. Hermon L. Van Valkenburg, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed June 22, 1905. A high-potential system of distribution includes two interlocking electromagnetically-operated switches, one an oil switch and the other a transfer switch for connecting the oil switch to either of two conductors.

933,217. TIME-CONTROLLER CIRCUIT-CONTROLLING MECHANISM. Frank W. Wood, Newport News, Va., assignor to Charles Cory and John M. Cory, New York, N. Y. Filed April 20, 1906. A transmitter, comprising a periodically actuated circuit-closer, electrically controls an indicator to display successive intelligencies.

933,218. DANGER-ZONE SIGNAL FOR TURRETS. Frank W. Wood, Newport News, Va., assignor to Charles Cory & Son, New York, N. Y. Filed June 8, 1908. Each of a number of circuit-controlling devices for respective signaling instruments comprises a series of contact strips of progressively increasing length, and contact brushes on a sweep

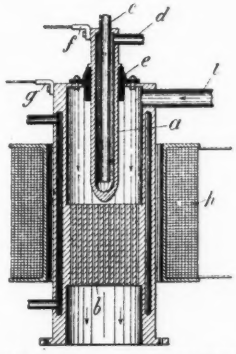
arm engage these strips as the turret is turned, thereby establishing electrical connections to the signaling instruments.

933,220. DYNAMO-ELECTRIC MACHINE. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed November 3, 1906. Describes in detail a rotor for a dynamo-electric machine.

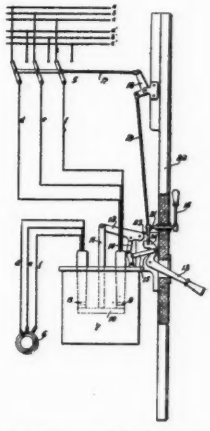
933,226. DYNAMO-MACHINE CONSTRUCTION. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed May 17, 1906. A combined brush yoke and oil guard consists of a circular member secured to the shaft bearing and closely surrounding the shaft. In its surface adjacent the shaft is a groove containing an absorbent material in contact with the shaft. One or more brush studs are secured to it.

933,228. TELEPHONE ATTACHMENT. Joseph B. Burkholder, Minneapolis, Minn. Filed April 3, 1909. Has two perforated disks, one of which may be turned so that the perforations are out of register so as to exclude air when telephone is not in use; an antiseptic pad is also included.

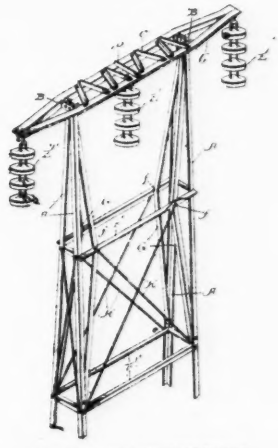
933,267. DYNAMO-ELECTRIC MACHINE. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed January 31, 1907. The field magnet pole-piece has a pair of concentric shunt coils near the armature end of the pole, a superimposed series coil, and tee or channel-shaped spacing members between all the coils.



933,094.—ART OF TREATING GASES ELECTRICALLY.



933,211.—SYSTEM OF DISTRIBUTION.



933,493.—TRANSMISSION TOWER.

933,296. LOCKING DEVICE FOR INCANDESCENT-ELECTRIC LAMP BULBS. Levi Davis, Alton, Ill. Filed March 15, 1909. Seated in the lamp socket is a bulb which engages with a locking member movable in a ring fitted to the socket.

933,335. TELEPHONE SUPERVISORY SYSTEM. William S. Paca, Oil City, Pa. Filed November 13, 1908. Includes a device for producing a clicking sound in the operator's receiving telephone when the circuit is opened or closed by a subscriber's hook switch.

933,369. ELECTRIC ALARM-SIGNAL. Henry J. Hovey, Chicago, Ill., assignor to Bryant Zinc Company, Chicago, Ill. Filed July 18, 1908. Diagonally arranged electromagnets actuate a centrally pivoted armature which operates a hammer device, all being contained within the gong.

933,399. DYNAMO-ELECTRIC MACHINE. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed February 2, 1905. Describes the details of a dynamo-electric machine devised so that an energizing field of definite frequency is produced and which rotates relatively in the same direction as the rotor windings.

933,404. TELEPHONE APPARATUS. Kelley M. Turner, New York, and Howell W. Haff, Babylon, N. Y., assignors to General Acoustic Company. Filed January 6, 1909. The cover of the battery case has a depression in its upper face from which project upwardly spring arms to engage a transmitter adapted to be inset in the depression; a receiver and flexible cord connections to establish a telephone circuit are also included.

933,412. ELECTRIC CALL AND ALARM SYSTEM. Otis O. Baker, Port Allegany, Pa., assignor of one-tenth to Joseph Silman, one-twentieth to Daniel S. Helmer, one-twentieth to William J. Barrho, one-twentieth to Mark M. Pomery, one-twentieth to M. Lafayette App, one-twentieth to Daniel McConeghy, one-twentieth to Miles N. Allen, one-twentieth to Barber D. Allen, and one-twentieth to Manley C. Field, Port Allegany, Pa. Filed March 23, 1907. Includes an electric alarm and annunciator.

933,418. DEVICE FOR TIMING WAGONS. Edward F. Chandler, Brooklyn, N. Y. Filed September 29, 1906. An electromagnetic perforating device is connected to a rotating mechanism on the dial of which it operates when jarring produced by the motion of the vehicle operates a spring-actuated, gravity-operated, circuit-controlling device.

933,440. AUTOMATIC TRAIN STOP AND SIGNAL. William H. Harris, Stark, Mont., assignor of one-half to William Garriety, Lothrop, Mont. Filed February 1, 1909. Trip-operated means connect with a device to control the engine throttle-valve and also energize a solenoid to operate an electric alarm signal.

933,450. ELECTRIC IGNITER FOR GAS-STOVES. Rudolf Hofmeister, St. Louis, Mo., assignor of one-half to John P. Casey and one-fourth to Louis C. Pausch, St. Louis, Mo. Filed February 9, 1909. Comprises a pair of electrodes, contacts for the same, and means for causing a spark between the former when desired.

933,457. PROCESS FOR UNITING RAILS AND OTHER METAL PIECES. Charles F. Jacobs, Chicago, Ill., assignor to Jacobs Welding Company, Chicago, Ill. Filed October 11, 1907. Molten flux and metal are applied to the joint through which an electric current is passed to heat it further and pressure is applied to bring the parts to be joined into close contact.

933,458. PROCESS FOR BONDING RAILS. Charles F. Jacobs, Chicago, Ill. Filed May 28, 1908. Similar to the preceding.

933,459. PROCESS OF UNITING METAL PIECES. Charles F. Jacobs, Chicago, Ill. Filed May 28, 1908. Similar to No. 933,457.

933,489. ELECTRIC SWITCH. Henry E. Reeve, New York, N. Y. Filed May 12, 1908. Renewed June 17, 1909. A cam engages the shoulder of a spring contact arm (carried by the frame of the switch) to move the arm in one direction and to release the arm by moving a spring catch which supports the arm.

933,493. TRANSMISSION-TOWER. Daniel R. Scholes, Chicago, Ill., assignor to Air Motor Company, Chicago, Ill. Filed September 21, 1907. At each side is a vertical standard consisting of two upwardly-converging corner posts; a pair of horizontal braces connect the posts at their upper ends, and a number of horizontal braces connect the posts at various levels so as to divide the faces of the tower into panels.

933,499. HEAD-GEAR FOR SUPPORTING LIGHTS. Daniel E. Taylor, Willimantic, Conn. Filed October 30, 1908. An adjustable spring-metal band, adapted to extend over and clutch the head, carries at one end an electric light.

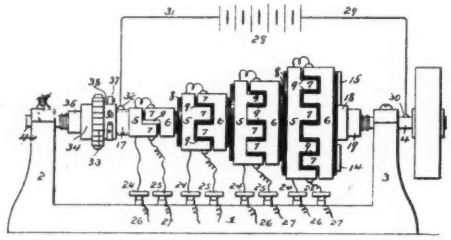
933,505. TROLLEY-BASE. Ferdinand Volk, Pittsburg, Pa. Filed November 3, 1908. Comprises a spring-carrying cap revolubly mounted on a suitable support, with housings, connected by tracks, mounted on the springs, a yoke carried by the cap, and means carried by the yoke to engage the tracks and simultaneously depress the housings to put the springs under tension.

933,506. ELEVATOR. Benjamin M. Walpole, Providence, R. I. Filed February 2, 1909. Differential gearing controlling the

elevating mechanism is driven by two motors revolving in opposite directions; an electromagnetically controlled brake for the rotating drum of the elevating mechanism, in circuit with the motors, is also provided.

933,525. PRIMARY BATTERY. William M. Brodie, East Orange, N. J. Filed April 7, 1909. The metal jar serves as one pole of the battery; a resilient support for one of the elements is electrically bonded to the jar and an element opposite polarity is resiliently secured to the top of the jar and insulated therefrom.

933,539. INCANDESCENT ELECTRIC LAMP. Carl Farkas and Herman J. Jaeger, New York, N. Y. Filed August 24, 1908. A metallic-filament lamp has a metallic filament of four loops hanging in the hooks of flat elastic hangers (secured near the top end of a standard of non-conducting material) and cemented alternately with their free ends to the leading-in wires and the free side ends of T-shaped elastic conductive supports (secured to the bottom portion of the standard) so that the loops are connected in series.



933,557.—ELECTRICAL SIGNALING APPARATUS.

933,557. ELECTRICAL SIGNALING APPARATUS. Owen L. Harrison, Coleta, Ill. Filed October 2, 1908. Comprises a series of rotary commutators, each adapted to interrupt an electric circuit at a different frequency from the others, means for including each of the commutators in a different external circuit, an electromagnetic device for operating the commutators simultaneously, and means for operating this device at uniform speeds.

933,564. TELPHER SYSTEM. Beverly T. Hitch, Allen, Md. Filed October 9, 1908. Includes a main line with upper and lower trolley wires, a siding, a movable cross-arm constituting a switch member, and a car having two trolley wheels, one adapted to run over, and the other under, the cross-arm.

933,577. TEMPERATURE-CONTROLLING DEVICE. William B. D. Penniman, Baltimore, Md. Filed November 20, 1905. High and low temperature conduits, with a valve in each of the latter, are connected to a main conduit; a motor-driven power shaft is normally disconnected from the valves, and means controlled by the shaft operate to connect one or other of the valves to the shaft. The motor current is controlled by a thermostatic device.

933,622. ELECTRICAL COOKING APPARATUS. Trevor M. Caven, Kansas City, Mo., assignor to Isaac C. Soule, Kansas City, Mo. Filed September 24, 1907. Describes in detail an electric cooker.

933,644. WEATHERPROOF SOCKET FOR ELECTRIC LAMPS. Gilbert W. Goodbridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed June 1, 1908. Comprises an insulating body with lamp-holding terminals therein, terminal plates with binding screws on the back of the insulating body, an inclosing and supporting cap for the back of the socket, electrical connections from the lamp-holding terminals to the plates, and insulating compound filling the space in the body back of the lamp-holding terminals.

933,661. WALL-CABINET FOR ELECTRICAL APPARATUS. Henry T. Paiste, Philadelphia, Pa. Filed March 24, 1908. Consists of independent pressed-up sheet metal end and intermediate units, with castings forming corner pieces connected to hold together the end and side portions of the end units, the corner pieces having each an inwardly and an outwardly extending lug and being also extended to form a supporting foot.

933,664. SUPPORT FOR INCANDESCENT ELECTRIC LIGHTS. Frank D. Powell, Monroe, Mich. Filed August 8, 1908. A perforated member is attached to the electric-lamp socket and may be suspended from any of the perforations by a rod attached to a clamp gripping the electric-light wires, so that the position of the lamp may be adjusted to a desired angle.

933,697. ELECTROLYTIC CONDENSER COMBINED WITH AUTO-TRANSFORMER. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. Filed July 13, 1907. In combination with an electrolytic condenser of many cells is an auto-transformer having its coils divided into portions each in shunt to one of the condenser cells.

933,716. SWITCHBOARD. Reason C. Livingston, Spring Valley, Minn. Original application filed May 21, 1908. Divided and this application filed November 20, 1908. Describes a form of telephone switchboard.

933,717. PROCESS OF TREATING ORES. Alfred A. Lockwood and Marcus R. A. Samuel, London, England. Filed January 11, 1909. The ore is mixed with a magnetic substance and oil gas tar which causes the magnetic substance to adhere to some constitutent part of the ore in preference to others, so that the mixture can be magnetically separated.

933,720. SUBMARINE SIGNALING. Josiah B. Millet, Boston, Mass., assignor to Millet Signal Company, Boston, Mass. Filed May 18, 1909. A contact wall is in acoustic contact with an electro-microphonic device, and means are provided for adjustably applying the contact wall to the ship's skin or other solid body acoustically connected thereto.

933,726. TELEGRAPH-KEY. Frank W. Smith and De Witt C. Conkling, New York, N. Y. Filed June 6, 1908. Comprises an electromagnet, an armature vibrated thereby, means controlled by the armature for making and breaking circuit to line, a manually controlled device for closing circuit to the magnet, and means for normally retaining the armature against the poles of the magnet.

REISSUE.

13,019. CONTROL SYSTEM FOR ELECTRIC HOISTS. Jay H. Hall, Cleveland, Ohio, and James F. Schnabel, New York, N. Y., assignors to The Electric Controller and Manufacturing Company, Cleveland, Ohio. Filed May 3, 1909. Original No. 915,290, dated March 16, 1909. Comprises an electric motor, a magnetic brake having its releasing winding normally in series with the motor, and a controller arranged to connect the field windings of the motor and the winding of the brake in a circuit containing a resistance and to connect the armature of the motor in another circuit containing a resistance.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 13, 1909:

482,339. ELECTRIC LIGHT FIXTURE. Edwin R. Crolius, Chicago, Ill.

482,343. ENCLOSED CONDUCTOR FOR ELECTRIC RAILWAYS. George A. Dupuis, Detroit, Mich.

482,374. AUTOMATIC ELECTRIC CUTOUT. Cyprien O. Mailloux, New York, N. Y.

482,397. VENTILATING ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Elihu Thomson, Lynn, Mass.

482,420. ADJUSTABLE THERMOSTAT. Melvin D. Compton, Newark, N. J.

482,422 and 482,423. RAILWAY-CROSSING PROTECTOR. Robert J. M. Danley, Columbus, Ohio.

482,425. GALVANIC BATTERY. Thomas T. Eckert, New York, N. Y.

482,433. SAFETY DEVICE FOR ELECTRIC CIRCUITS. Llewelyn B. Atkinson, London, England.

482,435. ELECTRIC ARC LAMP. Henry J. Cutler, Waltham, Mass.

482,440. TELEGRAPH RELAY. William Maver, Jr., New York, N. Y.

482,444. VOLTAIC PILE. William E. Washburn, Cedar Rapids, Iowa.

482,464. BURGLAR ALARM. Homer T. Wilson, Louisville, Ky.

482,486. LINE-WIRE-TIGHTENING DEVICE FOR ELECTRIC LAMP SUPPORTS. Charles A. Pfluger, Chicago, Ill.

482,549. MEANS FOR CONTROLLING ELECTRIC GENERATION. Thomas A. Edison, Menlo Park, N. J.

482,568. ELECTRIC ARC LAMP. Hubert H. Bigland and John Burns, Newcastle-on-Tyne, England.

482,586. ELECTRICAL FURNACE. Thomas Parker, Newbridge, England.

482,594. ELECTRIC LOCOMOTIVE. Wm. H. Soley and Wm. W. Perkins, Philadelphia, Pa.

482,668. ELECTRICAL APPARATUS. Leonidas G. Wolley, Grand Rapids, Mich.